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Barriers and facilitators of investigation coverage among index tuberculosis case contacts in rural Mbarara district, Uganda

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JOHANNESBURG

Barriers and facilitators of investigation coverage among index tuberculosis case contacts in rural Mbarara district, Uganda

By

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A research report submitted to the Faculty of Health Sciences in partial fulfilment of the requirements for the degree of MSc in Epidemiology in Implementation Science.

Division of Epidemiology and Biostatistics

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DECLARATION

I, Paddy Mutungi Tukamuhebwa, declare that this Research Report is my unaided work. It is being submitted for the Degree of Master of Science in Epidemiology in Implementation Science at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

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DEDICATION

To my parents John Mwesigye and Phabice Tumuhimbise (RIP), for their immeasurable support and encouragement in the early stages of my career.

ABSTRACT

Background: In 2012, the World Health Organization (WHO) recommended the investigation of contacts of index tuberculosis (TB) patients in low and middle-income countries (LMICs) as a strategy for accelerating TB case detection. Despite this WHO policy guidance, coverage of TB contact investigation in Uganda remains low nine years after adopting this recommendation. Studies identifying the barriers and facilitators to optimal TB contact investigation coverage have only been done in urban areas in Uganda and Kenya.

Aim: To explore health providers perspectives of the factors that influence TB contact investigation coverage in three rural, primary health facilities (PHC) in Mbarara District, South Western Uganda.

Methods: An exploratory qualitative study design was used to conduct semi-structured interviews with health workers involved in the TB program at the district, health facility and community levels between February 2020 and July 2020. The sample included the district TB supervisors, health facility TB focal persons, nurses, clinical officers and Community Health Workers (CHWs). The data were tape-recorded, transcribed and uploaded into MAXQDA for analysis. The analysis was done inductively using reflexive thematic analysis in six iterative steps: familiarization with the data, creating initial codes, theme search, reviewing the themes, developing theme definitions, and report writing. Five domains of the Consolidated Framework for Implementation Research; characteristics of the intervention, inner setting, outer setting, individuals involved and implementation process—were used to guide the development of semi-structured interviews and identification of barriers and facilitators of TB contact investigation.

Results: Nineteen health workers, two district TB and supervisors, five clinical officers, five nurses, six community health workers and one laboratory staff participated in the research representing a 100% response rate. Intervention-related factors, healthcare system factors, and contextual factors were the three themes that emerged from this research. Health system barriers comprised inadequate or delayed funding, staff shortages, insufficient personal protective equipment and stock-out of GeneXpert cartridges. Contextual obstacles included rough terrain, poverty, and stigma associated with TB and COVID-19. Increased knowledge and understanding of the intervention, strong leadership and teamwork, and on-the-job training of health workers were all facilitators. All of the CFIR domains were important in examining the challenges and enablers of contact investigation coverage.

Conclusion and recommendations: In this study, we were able to identify provider opinions on the barriers and facilitators of TB contact investigation coverage by using the Consolidated Framework for Implementation Research. The intervention-related, health system and contextual factors identified from this research may be used to guide the development of tailored interventions for rural hard to reach communities. To increase TB contact investigation coverage in rural areas, the National TB and Leprosy Program should advocate for increased funding to the TB program and address barriers in the flow of funds up the grass-root level. The government also should address the staffing gaps, strengthen the supply chain of essential suppliers and reinforce all the health system components. The Ministry of Health should also develop stigma reduction interventions and explore interventions for reaching out to hard to reach rural populations.

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OPERATIONAL DEFINITIONS

Active TB: This is a disease that affects people who have been infected with Mycobacterium tuberculosis. Cough, fever, and weight loss are some of the signs and symptoms of active tuberculosis. (1).

Close contacts: These are people who have spent one or more days or nights with the index patient in the past three months (2).

Contact: This is an individual who has been exposed to an index TB case, either inside or outside the home, such as at school, work, jail, and other places (3).

Contact clinical evaluation is a systematic process for assessing and diagnosing active TB among contacts or excluding TB among contacts without the disease (3).

Contact investigation coverage: The percentage of people with bacteriologically confirmed tuberculosis who had their contacts evaluated for the disease. (4).

Contextual factors: These are factors related to the underlying systems, culture, and environment where the intervention is being implemented (5). Such contextual factors include internal and external stakeholders, leadership support, economic background, hospital capacity and infrastructure, political climate, financial resources, organizational networks, communications, and geographical factors (6).

Cosmopolitanism refers to the “degree to which an organization is networked with other external organizations” (7).

Coverage is defined as “the integration of a practice within a service setting and its sub-systems” (8, p.70). It is obtained by dividing the number of people who use a service by the total number of eligible people (8).

Index tuberculosis case refers to the first diagnosed case of new or recurrent TB in specific households or other locations where other people may have been exposed (3).

Latent TB infection: Latent TB infection refers to a scenario where a person is infected by Mycobacterium tuberculosis, but the body's immune response contains the infection. Therefore, the bacteria remain dormant in the body without causing disease, and people remain asymptomatic and do not transmit the infection (2).

Tuberculosis is a bacterial infectious disease transmitted through the air and caused mainly by *Mycobacterium tuberculosis* (9).

Tuberculosis contact investigation: It is a TB control strategy for identifying, locating, and assessing contacts of index TB cases. Effective contact investigations halt the spread of tuberculosis in populations and aid in the prevention of TB outbreaks. (3).

LIST OF ACRONYMS

AIDS	Acquired Immunodeficiency Syndrome
ART	Antiretroviral Therapy
CBDOTs	Community-Based Directly Observed Treatment
CDC	United States Centre for Disease Control and Prevention
CFIR	Consolidated Framework for Implementation Research
CHW	Community health worker
COVID-19	Corona Virus Disease 2019
DHO	District health officer
DTLS	District Tuberculosis and Leprosy Supervisor
EGPAF	Elizabeth Glaser Pediatric AIDS Foundation
HC	Health Centre
HIV	Human Immunodeficiency Virus
HREC	Human Research Ethics Committee
MDR-TB	Multi-Drug Resistant Tuberculosis
MUST	Mbarara University of Science and Technology
MoH	Ministry of health
NTCA	National Tuberculosis Controllers Association
NTLP	National Tuberculosis and Leprosy Program
PEPFAR	The United States President's Emergency Plan for AIDS Relief
PPE	Personal Protective Equipment
RE-AIM	Reach Effectiveness Adoption Implementation and Maintenance
RHITES-SW	Regional Health Integration to Enhance Services in South Western Uganda
TB	Tuberculosis

TDR	Special Program for Research and Training in Tropical Diseases
UNAIDS	United Nations Program on HIV and AIDS
UNCST	Uganda National Council of Science and Technology
UNDP	United Nations Development Program
UNICEF	United Nations Children's Fund
USA	United States of America
USAID	United States Agency for International Development
WHO	World Health Organization
XDR-TB	Extensively Drug-Resistant Tuberculosis

CHAPTER 1: INTRODUCTION

This chapter discusses tuberculosis (TB), its epidemiology, and contact investigations as one of the TB control interventions. A description of the processes involved in TB contact investigation and how it is done to control the disease in Uganda is also covered. Coverage, the implementation outcome of interest in this study, is discussed in the context of contact investigation.

1.1. Background

Tuberculosis is a bacterial infectious disease spread through the air. It is caused primarily by a bacillus called *Mycobacterium tuberculosis*, which is spread when TB patients expel the bacteria into the air (4, 9). The disease mainly affects the lungs (pulmonary TB), but it may also affect other organs such as the brain, kidney, intestines, and bones (extrapulmonary TB) (9). It is a major cause of illness and is even the ninth leading cause of death worldwide (10). About a quarter of the world's population is infected with latent TB, putting them at risk of developing active TB (4). In their lifetime, 5-10% of people with latent tuberculosis will experience active TB disease (11). The risk of TB disease is even higher among people living with HIV and those with other risk factors like undernutrition, diabetes, smoking and heavy alcohol consumption (12).

The mortality rate of TB without treatment is very high, with 70% of sputum smear pulmonary TB patients dying within the first ten years of diagnosis (12). However, most TB patients can be healed, and further transmission of the infection stopped with timely

diagnosis and treatment (4). The recommended TB diagnostic tests in Uganda include rapid molecular tests (GeneXpert), sputum smear microscopy and culture-based methods (12). The current treatment for drug-susceptible TB patients in Uganda is six months of first-line TB drugs split into two months of isoniazid, rifampicin, pyrazinamide, and ethambutol in the intensive phase, followed by four months of rifampicin and isoniazid in the continuation phase (13). The treatment for drug-resistant TB is much longer and requires more costly and toxic treatment regimens (12).

1.2. Epidemiology of tuberculosis

In 2018, it was estimated that there were 10 million new cases of active TB and 1.5 million people died of TB, of which 82% happened in Africa (4, 14). Although the African region has 9% of the world population, the region contributed 25% of all new TB cases in 2019, becoming the continent with the second-highest TB cases after South-East Asia (Table 1). TB in Africa is mainly driven by the HIV pandemic, with about 50% of TB cases co-infected with TB and HIV (15). TB is also the top cause of death among patients with HIV causing more than 30% of all AIDS-related deaths (16).

Table 1: Regional TB incidence 2019

WHO Region	Estimated TB incidence
Africa	1,460,000
Americas	290,000
Eastern Mediterranean	819,000
Europe	246,000
South-East Asia	4,340,000
Western Pacific	1,800,000
Global total	9,960,000

1.3. Tuberculosis in Uganda

TB is a significant public health threat in Uganda, with an estimated 200 cases per 100,000 people in 2018 (17). Uganda is ranked among the top 30 countries with the highest TB/HIV burden (18). HIV mainly drives Uganda's TB burden, with an estimated 41% of TB patients co-infected with HIV in 2018 (19). As a result, Uganda has strengthened TB/HIV collaborative efforts by increasing HIV testing among TB patients, TB screening among HIV patients and initiating antiretroviral therapy (ART) and TB treatment among TB/HIV co-infected patients (19). Of the 52,485 notified TB cases in Uganda in 2018, 99% had a documented HIV status, and of these, 21,306 (41%) were HIV positive. Also, 98% of the HIV positive cases were started on ART, higher than the WHO Africa target (86%) for the same period (4, 19).

Uganda faces the challenge of low TB case notification. In 2014, there were 87,000 new TB cases, but only 47,171 were notified, indicating that about 50% of patients were missed (20). The gap in notifications is attributed to under-diagnosis, inadequate reporting of the identified TB cases, limited access to health services, incomplete

linkages with other stakeholders (private providers, hospitals, laboratories, non-governmental organizations) and lack of enforcement (21). Missed TB cases represent an increased risk of TB transmission through continued exposure to TB among family and community members (22). In fact, for each year one TB patient spends untreated, they infect on average 10 to 15 people (23). Therefore, Uganda has to close this gap to achieve the WHO End TB strategy milestones of reducing TB incidence by 90% and mortality by 95% between 2015 and 2035 (24).

1.4. Tuberculosis contact investigation

In 2012, the WHO recommended investigating contacts of persons with infectious TB in low and middle-income countries to increase TB case detection rates (25). This intervention involves systematic screening and evaluation of contacts of confirmed TB patients for active or latent TB (25). The intervention also provides an opportunity to diagnose latent TB and scale-up of TB preventive therapy among the eligible contacts, including children below five years old, HIV positive patients, and other high-risk groups (2, 26). Five years later, in 2017, the Uganda Ministry of Health (MoH) adopted these WHO recommendations as high-level policy and integrated them into the Manual for Management and Control of TB and Leprosy in Uganda (27). Furthermore, in 2019, detailed operational guidelines were developed by the Uganda NTLP to guide and standardize TB contact investigation processes at the health facility and community levels (2).

Despite the WHO policy guidance, coverage of TB contact investigation in many TB high burden countries is still low. A meta-analysis showed low TB contact investigation coverage in five countries (2.8% in the Lao Republic, 4.8% in Kenya, 14.9% in

Pakistan and 15.1% in Uganda) and high coverage in one country (91.7% in the Democratic Republic of Congo) (28). In another study conducted in six public primary health facilities and one hospital in Central Uganda, TB contact investigation coverage was 20% among symptomatic TB contacts (29).

According to the National Tuberculosis and Leprosy Program (NTLP) guidelines on TB contact investigation, active contact investigation involves five steps: interviewing of the index TB patient, creating a contact tracing list, scheduling of health workers who will conduct contact tracing, planning of contact investigation activities, screening of all contacts for TB and clinical, bacteriological with or without radiological investigation of all the symptomatic contacts for TB at the health facility (2). According to the 2019 guidelines for TB contact investigation in Uganda, the following categories of index TB patients are prioritized for TB contact investigation: bacteriologically confirmed pulmonary TB (smear-positive, Xpert positive or culture-positive), cavitation of the chest X-ray, Multi-Drug Resistant TB (MDR-TB), children under five years and people living with HIV (2).

1.5. Problem statement

The Revised National Strategic Plan (2015/2016-2020/2021) of the NTLP raises TB contact investigation coverage as a barrier to achieving the TB case detection target of 78% (30). Armstrong et al. (2017), in a prospective multi-centre observational study conducted in Kampala, Uganda, reported significant drop-out rates across the steps in the contact investigation cascade (29). Their study found that among the 338 clients eligible for TB contact investigation, only 61% were scheduled for home visits, and

only 50% of them were visited (29). Furthermore, among the 131 people who were screened and needed definitive evaluation, only 20% received it (29).

In rural Uganda, the coverage of TB contact investigation is much lower (15.1%) than that in urban areas (20%), and yet many of the missing TB cases are in such hard to reach and underserved rural areas (28, 29). This low coverage of TB contact investigation increases undiagnosed and untreated TB patients, thus propagating the TB pandemic. Furthermore, without TB contact investigation, many TB patients miss identification, prompt treatment, infect other people in the household and the community or die from TB related complications (31).

The low coverage of TB contact investigation contributes to the high number of missed TB patients in Uganda (400,000 in 2014) and the high TB transmission rates, which could slow down the progress towards achievement of the third United Nations Sustainable Development Goal of ending the TB epidemic by 2030 (32).

1.6. Justification

Given that most studies have mainly centred on urban settings, the justification for this research is to understand the barriers and facilitators to coverage of TB interaction investigation in rural Uganda. For example, two studies in Uganda have explored the barriers and facilitators to TB contact investigation coverage; however, they were both conducted in Uganda's capital city, Kampala (33, 34).

The stop TB partnership recommends that, given sub-national TB epidemiological variations, contact investigation approaches be tailored to the rural and hard to reach settings (35). This is consistent with findings from a Tanzanian study which found differences in clinical characteristics and intestinal worm co-infection patterns among TB patients in rural and urban areas, thus recommending tailored public health interventions to the different settings (36). Poverty, scarcity of health facilities and long distances to and from health facilities significantly reduce the ability of TB contacts who reside in rural areas to obtain TB evaluation and treatment (37).

Even though 82% of the Ugandan population lives in rural areas, there is inadequate information about TB contact investigation coverage and its barriers and facilitators in rural settings (20). This study aims to contribute to the literature on the barriers and facilitators of investigation coverage among contacts of TB patients in Uganda. It is expected that the information and results from this study will contribute to policy recommendations that guide TB contact investigation in Uganda.

1.7. Research question

What are the health workers perspectives of the factors that influence coverage of TB investigation among contacts of index clients in three rural, primary health facilities in Mbarara District, South Western Uganda?

1.7.1. Aim of the study

To explore health worker's perceptions of the factors that influence coverage of TB investigation among contacts of index clients in three rural, primary health facilities in Mbarara District, South Western Uganda.

1.7.2. Objectives

1. To use the CFIR to explore health workers' experiences of the barriers of TB investigation coverage among contacts of TB index clients in three rural primary health facilities in Mbarara district in Uganda.
2. To use the CFIR to explore health workers' experiences of the facilitators of TB investigation coverage among contacts of TB index clients in three rural primary health facilities in Mbarara district, Uganda.

CHAPTER 2: LITERATURE REVIEW

This chapter includes literature on the barriers and facilitators of TB contact investigation coverage presented under health system, provider, patient-related and contextual factors (38). Implementation studies identifying barriers and enablers of TB contact investigation coverage in low- and middle-income countries were identified through a systematic literature search using the PubMed and Embase databases. Furthermore, the Consolidated Framework for Implementation Research and its domains and application as a determinant framework are discussed.

2.1. Barriers and facilitators of TB contact investigation coverage

2.1.1. Health system-related factors

Health system factors such as leadership and governance, operational guidelines, tools, medicines and technologies, and service delivery have been shown to influence TB contact investigation in similar studies conducted in Kenya and Ethiopia (26, 39). This is substantiated by findings from an Ethiopian qualitative implementation research study that found a lack of monitoring and supervision, lack of operational guidelines, shortage of health workers, electricity interruption, shortage of reagents, inadequate funds and faulty microscopes were key bottlenecks to optimal contact investigation coverage (14). These challenges affected all the contact investigation processes, from arranging household visits to the point of contact evaluation which may eventually affect TB contact investigation coverage. However, both studies do not explicitly explore the factors influencing contact investigation coverage.

The Kenyan study demonstrated that all the six WHO health system components (service delivery, leadership and governance, health information, health workforce, funding, medicines and technologies) significantly influence the quality of TB care offered to index patients and their contacts, thus affecting TB contact investigation coverage (14). Similarly, their study also used qualitative methods and interviewed health workers index TB patients and experts from government and non-governmental organizations. However, no published implementation research studies have been conducted in a similar setting.

In a study conducted in an urban city in Uganda, Ayakaka et al. found that prioritizing contacts by attending to them first when they presented to the health facility and psychosocial support by lay health workers contributed to improved TB contact investigation coverage (33). Evidence suggests that contacts may not perceive their risk of TB. Therefore, systems should be re-arranged to ensure contacts are attended to first when they arrive at health facilities (14).

In the same study by Ayakaka et al., the excellent interpersonal communication skills of lay health workers were found to be an enabler for TB contact investigation coverage (33). Effective interpersonal communication helps build trust between index TB patients and health workers and encourages index patients to bring contacts to the health facility for TB evaluation (33). Their study found that contacts of TB patients would attend the TB clinic for evaluation if the information is given to them by lay health workers because they did not want to be sick for an extended period.

Community health workers have been documented to improve TB contact investigation coverage in the upper, middle- and low-income countries (33, 40, 41). Evidence from two qualitative studies in Uganda and Kenya shows that home visiting by community health workers is another facilitator influencing the successful implementation of TB contact investigation (33, 41). These studies found that a flexible and personalized home visiting schedule allowed community health workers to visit household contacts at convenient times, such as weekends and nights (33). The methods used in these two studies are similar to Lestari et al. They used implementation research tools to bridge gaps in TB contact management in a high burden setting in Indonesia (42).

2.1.2. Provider-related factors

A mixed-methods study by Tlale et al. (2016) in 31 health facilities in Botswana found a wide variation in knowledge scores about TB contact investigation among different categories of providers (43). Surprisingly, the knowledge score was lowest among medical officers (17%) and highest among health education assistants (69%) (43). This knowledge gap was attributed to insufficient training about TB contact investigation as only about 60% of health workers had been trained, most of them being health education assistants (43). These findings are consistent with those from two other studies in Ethiopia and Mozambique (44, 45). In Uganda, the knowledge gap among health workers was attributed to the lack of TB contact investigation guidelines at health facilities (33). Equipping health providers with the requisite knowledge on contact investigation is essential for increasing coverage (43).

Tlale et al. also demonstrated that a negative provider attitude and the lack of commitment also compromises TB contact investigation (43). This study did not explore the reasons for the negative provider attitude; however, two studies in Ethiopia and Saudi Arabia associated it with the fear of being infected with TB (44, 46). This, in part, explains why most TB clinics are often understaffed. The few staff available are overwhelmed with work, thus leading to inadequate counselling on TB contact investigation and failure to conduct household visits (33). There is a lack of information on provider attitudes and their influence on TB contact investigation in Uganda.

Low provider motivation has also been demonstrated in two qualitative studies in Uganda and Kenya (33, 41). The low motivation was characterized by a lack of tools to use and a lack of resources such as airtime and phones for making phone calls and transport for community health workers (41). Consequently, some health facilities lack motivated and dedicated TB focal persons because they are not salaried and do not receive any benefits for the responsibilities that come with that role (47). Another demotivating factor was that TB focal persons did not receive any orientation on their roles and responsibilities following appointment and the lack of monetary incentives for that role (47).

2.1.3. Patient-related factors

TB-related stigma and inadequate knowledge among TB index patients and contacts have been widely reported in three qualitative studies conducted in Uganda, Kenya and Ethiopia (14, 33, 41). This stigma was worsened by the belief that every TB patient had HIV (33). Stigma also influenced the scheduling of appointments for index

patients. If their TB or HIV status or both were exposed, they were afraid of losing their privacy and being discriminated against (33, 41). This partly explains the TB index clients' secretive behaviour, such as denying their phone numbers or physical addresses and refusing to consent for home visiting (33).

Furthermore, Cattamachi et al., in a qualitative study conducted in Uganda on the barriers to delivery of routine TB diagnostic evaluation services, identified that poverty was a major bottleneck to diagnostic evaluation (38). They found that poverty combined with poor general health prevent presumptive patients from travelling to the health facility for diagnostic testing—a major component of contact investigation. Worse still, TB evaluation and management requires multiple return visits, which economically strain poor communities (38). This study, however, was conducted in the context of general TB evaluation. Similarly, a similar implementation research study by, Ayakaka et al. (2017) found that contacts lacked funds for travel to the health facility for evaluation (33).

Also, the same study by Catamenial et al. (2018) found that low TB related health literacy was a barrier to TB evaluation, a major aspect of contact investigation (34). The poor health literacy contributed to the belief in traditional and herbal medicines, which delayed access to health facility-based clinical evaluation. Literacy creates a foundation for good communication between index TB patients, contacts and community health workers, impacting the decision to attend or not attend TB clinics for definitive evaluation (34).

Patient-level facilitators of TB contact investigation have been documented in three qualitative studies in Ethiopia, Kenya and Uganda (14, 33, 41). These included awareness of TB symptoms, especially cough and social support from the family, such as paying for transport costs, praying for the sick, taking them to the health facility and covering them on the job (14). These studies illustrate the role of family support in alleviating social and economic challenges faced by TB patients and their contacts in TB investigation and management.

2.1.4. Contextual factors

2.1.4.1. Health infrastructure

TB contact investigation requires the infrastructure and resources for proper implementation, such as diagnostic equipment and working space for TB care (3). Evidence from Uganda and Ethiopia suggests that inadequate infrastructure such as lack of well-ventilated and dedicated spaces for TB counselling and management, electricity interruptions and lack of diagnostic equipment posed a challenge to TB contact investigation and general TB management (33, 41).

2.1.4.2. Geographical challenges

In most developing nations, the majority of the population live in rural areas where access to health services is difficult due to topographical factors such as forests, deserts and mountains (48). For example, a qualitative study in Uganda found that the physical remoteness of patients' homes and rough terrain with a poor road network were critical challenges to timely TB assessment and treatment (38). There is insufficient literature on the impact of geographical factors on TB contact investigation.

2.1.4.3. Organizational networks and communication

Peer feedback and open communication across hierarchies play a critical role in innovation and effective implementation as it allows free communication among team members (49). A study conducted in Uganda by Catamanchi et al. using qualitative methods found that poor communication, support and oversight by the national TB program negatively impacted TB clinical assessment and diagnosis. While teams from the national TB program visited sites for supervision, there was no effort by the national teams to give feedback to health facility staff which stifled TB diagnosis and evaluation efforts (38). However, this study focused mainly on the challenges affecting TB diagnostic evaluation, the final step in the TB contact investigation process.

2.1.4.4. Economic environment

A shortage of financial resources to conduct active TB contact investigation has been reported in two qualitative studies in Ethiopia and Kenya (14, 50). In Kenya, there was no central budgetary allocation for TB contact investigation activities. Consequently, contact investigation was mainly financed by partner organizations (41). In Ethiopia, the shortage of money for transport, registration at the health facility and food was an obstacle to visiting health facilities for TB diagnostic evaluation among contacts (41). (41). These studies illustrate that economic factors work at the health system and patient levels to frustrate contact investigation.

2.1.4.5. Political environment

Political commitment is one of the pillars of the WHO End TB strategy (51). The influence of politics on TB contact investigation coverage was documented in a mixed-methods study conducted in 60 high TB burden wards in India (52). This study found that local political leaders interfered with the implementation of TB contact investigation activities. For example, local leaders stopped community health workers from conducting active TB contact investigations by refuting the presence of TB in their localities (52). However, there is a paucity of data on political leaders' influence on TB contact investigation coverage in Sub-Saharan Africa.

2.1.4.6. Policies and guidelines

In 2012 the WHO released policy recommendations on TB contact investigation in low and middle-income countries (25). However, two qualitative studies in Uganda and Kenya have reported a lack of contextualized operational guidelines affecting TB patient care and contact management (25, 33, 41). Where procedures were available, there was a lack of knowledge about their existence (43). In Botswana, Tlale et al. (43) found that only 42% of the health workers were familiar with contact investigation guidelines. This study will explore issues related to the availability and implementation of these guidelines and how this affects coverage of contact investigation

2.1.4.7. Organizational incentives

Incentives are an essential enabler of active TB contact investigation and other community TB interventions (26). The lack of a reward and incentive system is known to create an unfavourable environment that impedes TB contact investigation and the provision of other health services (33, 43, 53). Some TB programs in low- and middle-

income countries lack incentives, especially to motivate lay health workers who conduct community-based TB activities (33, 41, 53). Two qualitative studies in Kenya and Uganda found that lack of payment to lay health workers for the time and costs involved in conducting community visits and lack of incentives negatively affected TB screening and diagnosis of contacts at the health facility (33, 38).

2.2. Conceptual framework

The conceptual framework used in this study was adapted from the Consolidated Framework for Implementation Research by Damschroder *et al*. in 2009 (49). The CFIR framework was chosen for this research because it is comprehensive and has been widely in Canada, Norway and South Africa to identify the barriers and facilitators of implementation outcomes in healthcare settings (54-57). Damschroder et al. developed the framework from a synthesis of 19 other implementation research frameworks. The CFIR has 39 constructs and five domains: the intervention, inner setting, outer setting, the individuals involved and the implementation process. The framework was adapted for this study, as highlighted below (Figure 1).

We used 21 out of the 39 constructs of the Consolidated Framework for Implementation Research (Figure 1) (49). The constructs were chosen based on the existing literature on determinants for implementing TB interventions in Africa (33, 41, 58). Semi-structured interview guides were developed to obtain information according to the five CFIR domains to explore the barriers and facilitators

to TB contact investigation. This framework will also guide the analysis and reporting of results.

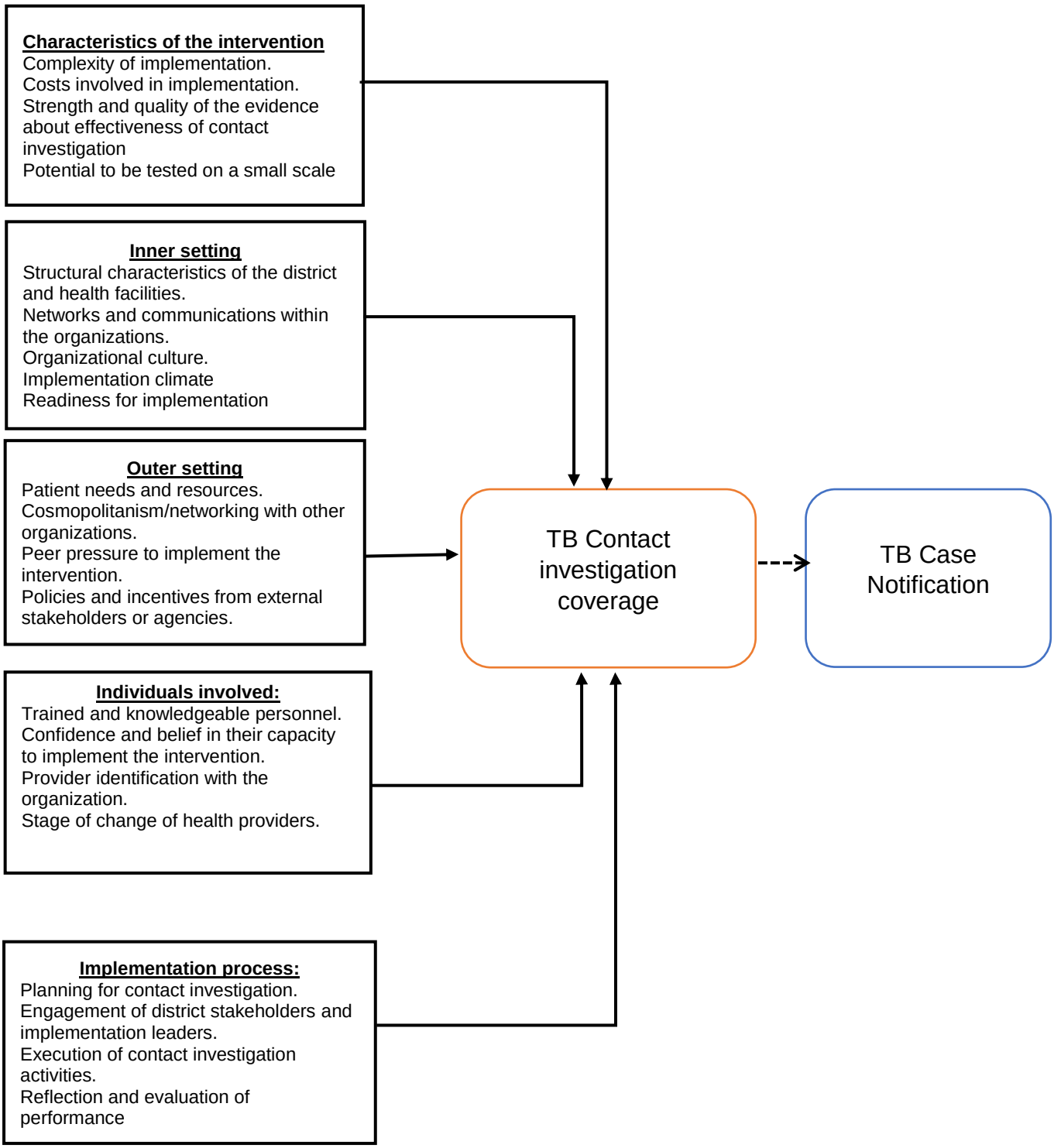


Figure 1: The adapted consolidated framework for implementation research (49).

2.2.1. The intervention

This domain entails characteristics of TB contact investigation that either hinders or enables the achievement of optimal coverage. Such characteristics inherent in the intervention itself might arise from difficulties associated with implementing TB contact investigation as reflected in the duration, disruptiveness of existing systems, and the number of steps involved in its implementation. Other intervention characteristics that might affect coverage include adaptability to the local context, relative advantage compared to other TB case notification interventions, costs associated with implementation, and the ability to be tested on a small scale (49). This domain will help understand how TB contact investigation is being conducted, including the procedures, steps and aspects of the intervention that are working well and vice versa.

2.2.2. The inner setting

This domain will cover the organization's internal aspects that act as challenges or enablers to TB contact investigation coverage in Mbarara district. Such internal aspects will include the organizational structure, internal communication networks, implementation culture and climate that could influence TB contact investigation coverage (49). This domain will help understand how individuals within district and health facilities interact, communicate, the extent to which an intervention is rewarded or supported and how ready they are to execute activities.

2.2.3. The outer setting

The outer setting includes external aspects of the organization such as the economic, social and political context of the study health facilities (49). This domain will be used to explore how inter-health facility or inter-district networks and external policies or incentives act to influence contact investigation coverage. Furthermore, we will explore the role of external policy (such as from the government or bilateral agencies) and competitive peer pressure from other districts and health facilities in influencing TB contact investigation coverage.

2.2.4. The individuals involved

This domain addresses the individual characteristics and behaviours of the people involved in implementing TB contact investigation in Mbarara district (49). The domain will help answer questions such as: “who is involved in TB contact investigation?” How confident they are to conduct the intervention and whether they have adequate knowledge, skills and training to provide the intervention.

2.2.5. The implementation process

The implementation process is the last domain of the CFIR, and it includes information on crucial activities in most organizational change models. For example, plan for TB contact investigation activities, engage stakeholders, execute actions, and reflect and evaluate performance (49). Under this domain, we will answer questions such as: “What plan is in place for conducting TB contact investigation activities? To what

extent is TB contact investigation conducted according to plan? And to what extent the appropriate stakeholders were involved in TB contact investigation?"

2.2.6. Previous application of the Consolidated Framework for Implementation Research

The CFIR has previously been used in multiple implementation research studies to evaluate interventions and identify the barriers and facilitators to implementation (59-62). A 2016 systematic review of the application of the CFIR found 26 studies in different fields which had applied this framework, and two of these studies were from low-income countries (63). These studies have shown that this framework is a valuable tool for conducting rigorous implementation research by guiding the study through different project levels: literature review, developing data collection instruments, structuring the results section and dissemination. As a determinant framework, this framework helps identify critical variables that influence implementation success (64).

In Africa, studies that used the CFIR included integrated hypertension-HIV management in Ugandan HIV clinics, role shifting for hypertension control in Ghana, a quality assurance program to expand vaccine coverage in Nigeria, and a mobile health network to improve TB case finding in Uganda (60, 65, 66). Meyer and colleagues have also demonstrated that this framework can be used within a randomized controlled trial conducted in Uganda to identify challenges associated with implementing a mHealth intervention in Uganda.

Regarding TB contact investigation, one ongoing study in Indonesia uses the CFIR to explore the barriers and facilitators to closing the knowledge to practice gap for TB

contact investigation (42). Lestari et al. are utilising this framework among other implementation research tools to perform a formative evaluation to understand the local context and the determinants to implement the TB contact investigation policy before rolling out the health intervention for improving TB contact investigation coverage (42).

CHAPTER 3: METHODOLOGY

This chapter describes the methods used in achieving the objectives of the study. It describes the study design and details about Mbarara district where this study was conducted. It also describes the study participants in terms of health workers involved in TB contact investigation in the district and how the participants were selected. This section also includes how the data was collected, managed and analyzed. Lastly, ethical considerations for the study are also discussed.

3.1. Study design

A qualitative exploratory study design was used to identify the barriers and facilitators of TB contact investigation coverage.

3.2. Study site

This study was conducted in Mbarara district, located in the southwestern region of Uganda, about 270 km southwest of the capital city, Kampala (Figure 2). The district is bordered on the northwest by Buhweju district, the north by Ibanda district, the east by Kiruhura and Isingiro districts, the west by Sheema district, and the south by Ntungamo district (Figure 3) (67). According to the 2014 population and housing census, Mbarara district population was 472,629 (Land area 1785.6 km^2), of which 59% resided in rural areas (67). a region with one of the lowest TB case detection rates in 2017 (50% against the target of 78%) (9). The district had 26 TB diagnostic centres and 31 TB treatment centres, all under the District TB and Leprosy

Supervisor's oversight. Regional coordination of TB activities is done by the western Uganda Zonal TB and Leprosy Supervisor (ZTLS) while national-level coordination and policy formulation is done by the National TB and Leprosy Program (NTLP) (33).



Figure 2: A map of Uganda showing the location of Mbarara district (70).

Districts neighbouring Mbarara district

1. Isingiro district
2. Kiruhura district
3. Ibanda district
4. Buhweju district

5. Sheema district
6. Ntungamo district

The Uganda health care system works on a referral basis, with the lowest level of TB care offered by community health workers known as Village Health Teams (VHT). Each village is expected to have a VHT. The following levels of health care increase in the package of services, staffing and geographical coverage from level two (II), three (III), four (IV), district referral hospitals and national referral hospitals.

This study was conducted in three level IV rural public health facilities in Mbarara District; that is, Bwizibwera Health Centre IV, Kinoni HCIV and Bugamba HCIV. Health centre IVs are “mini-hospitals” that serve counties. They offer a wide range of health services, including prevention, health promotion, outpatient care, maternity, inpatient, surgery, transfusion and laboratory services (68, 69). Purposive sampling was done to select the three health facilities because they offer the highest level of health care in the two rural counties (Rwampara and Kashari) of Mbarara district (Figure 3) and supervise lower health facilities at the sub-county level (69).

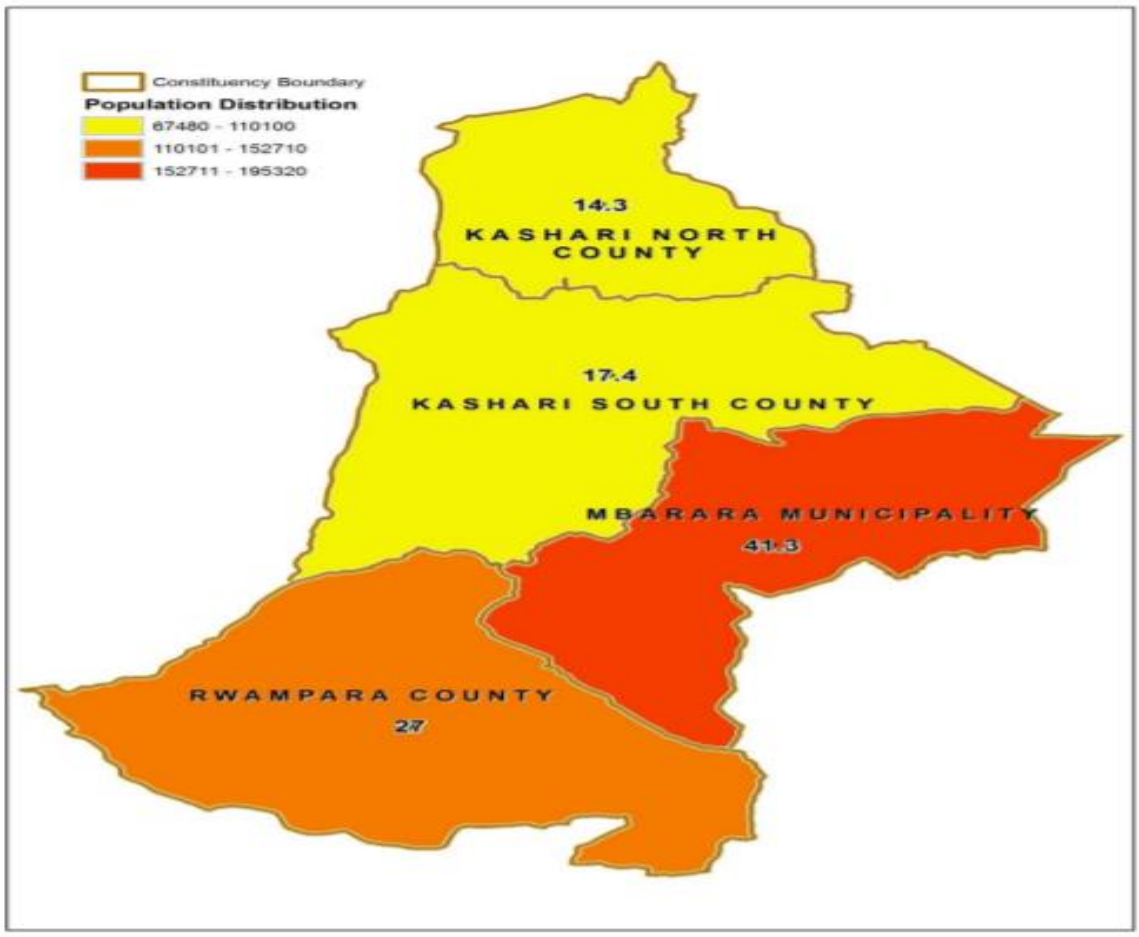


Figure 3: A map of Mbarara district showing counties in the district (70).

The health workforce at HCIVs includes physicians, clinical officers, nurses, midwives, laboratory technicians, dispensing staff and medical records staff. At the village level, a team of community health workers called “Village Health Teams” provide a referral, follow-up and community mobilization to increase demand for health services, including TB contact investigation (2, 69).

3.3. Study population

The study population comprised facility-based clinical staff from the three selected health facilities, TB linkage facilitators (Community Health Workers), District TB and

Leprosy Supervisor (DTLS) from January and June 2020. The health facility-based staff included clinical officers and nurses responsible for the day-to-day clinical management of patients and laboratory staff responsible for TB diagnostic testing.

3.3.1. Inclusion criteria

All health facility-based health workers involved in TB care and community health workers actively engaged in community TB interventions for at least one month were included in the study.

3.3.2. Exclusion criteria

All eligible health workers who were away from the health facility during the data collection period (May to June 2020) for any reason were excluded from the study.

3.4. Sampling of study participants

Purposive sampling of clinical staff and community health workers was done to include participants who were directly involved in implementing the TB program at the district, health facility and community levels. These participants were thought to be the most knowledgeable and experienced about the subject. At the district level, all the two DTLS were sampled, while at the facility level, the TB focal person and all the providers who met eligibility criteria were included in the study.

3.5. Data collection

3.5.1. Data collection instruments

Semi-structured interview guides were developed according to the five domains of the CFIR. The interview guide sections included background information about study participants, intervention characteristics, inner setting, outer setting, individuals involved, and the implementation process. Separate guides were developed for the DTLS, health workers and community health workers; however, the interview guide for the community health workers was translated into the local language (Runyankore). The Mbarara University of Science and Technology research ethics committee reviewed and validated translated versions of the interview guides. The interview questions were designed to collect information about how the intervention was being implemented, organizational issues, external factors, provider and patient factors and issues around the implementation process. Each interview was expected to last 40 minutes.

3.5.2. Pilot testing of instruments

After obtaining administrative clearance from the pilot sites, semi-structured interview guides were pilot-tested on four individuals (one clinical officer, one nurse and two community health workers) to check understanding of the questions and estimate the duration of the interviews. The pilot study data was done at two health facilities (Kakoba Health Centre III and Mbarara Municipal Health Centre IV), with similar staffing structures and services offered. The results and individuals from the pilot study were used to improve the interview guides. Eight questions that began with “to what extent….” were confusing to the participants by prompting quantitative responses.

Such questions were rephrased to stimulate open discussion. Interviews for the pilot study spent an average duration of 47 minutes per interview, and this information was helpful in planning the number of interviews to be conducted per day. Besides, we found that most study participants were engaged in patient care in the morning hours, and as a result, we planned our interviews for the main study in the afternoon and evening hours. The pilot testing also helped me practice interviewing and improving how the questions should be asked for the participants to understand easily.

3.5.3. Conducting the interviews

A one-day training of the research assistant was conducted to ensure quality data collection and analysis. The training covered: ethics in health research, such as confidentiality, privacy, consent, data protection, interviewing and transcription. Semi-structured interviews with health workers and community health workers were conducted at the respective health facilities, while the DTLSs were interviewed in their offices at the district headquarters. Interviews were conducted by the researcher in either English or the local language, Runyankore. A trained research assistant took field notes for all interviews. Each interview lasted about 40 minutes. Data collection for each category of study participants was continued until saturation was reached, that is, the point when no new codes emerged from the data being collected (70). To check for saturation, transcription and coding was done for each new recording, and the researcher checked for the emergence of new codes.

Given the current COVID-19 pandemic, prevention measures were taken in data collection on both the researcher and the participants. Interviews were conducted in

well-ventilated spaces, with both the interviewer and the participant wearing N-95 masks and surgical masks, respectively. In addition, the interviewer observed the Uganda Ministry of Health COVID-19 infection prevention guidelines, including handwashing or sanitization, social distancing and use of protective masks (71).

3.5.4. Ethical considerations

The Human Research Ethics Committee at the University of the Witwatersrand Medical (M200101) and the Research Ethics Committee at Mbarara University of Science and Technology (MUREC 1/7) provided ethical clearance. The Uganda National Council of Science and Technology granted permission to conduct research in Uganda (Registration number: HS569ES). Furthermore, the District Health Officer of Mbarara district and the health facility managers of the respective health facilities where the study was conducted provided administrative approval to access health facilities.

The lead researcher gave detailed information about the study in either English or Runyankore (the local dialect). The participant information sheet was read out to the participants, and then they were allowed to ask questions before accepting to participate in the study. All participants were given a written informed consent form to sign and separate written informed consent for audio recording before the interview. Participants were also informed of their right to deny consent or withdraw their participation at any time during the interview session without any penalty.

All the recordings and transcripts were kept secure in a locked cabinet to ensure participant information privacy. The transcripts were anonymized by excluding all identifiers. Electronic transcripts were stored in password-protected computers only accessible to the principal investigator and research assistants. The audio recordings will be stored for two years after the research results are released or six years if no publications are produced as a result of the analysis.

3.5.5. Reflexivity

At the beginning of each interview, the principal investigator introduced himself as an MSc in Epidemiology student with a medicine and TB care background. The investigator also informed the participants that he was not affiliated with Mbarara district health department or the ministry of health NTLP to enable participants to share information freely without fear of being penalized. Before the study, the principal investigator received training in qualitative research methods at the University of the Witwatersrand, making him conscious of how a researcher's background, location and assumptions could affect a qualitative study.

3.6. Data management

The data were transcribed verbatim into Microsoft Word by the principal investigator and the research assistant. After transcription, the research assistant translated all the interviews conducted in Runyankore into English.

3.7. Data analysis

The data were analyzed using reflexive thematic analysis in six iterative phases described by Braun and Clarke (2006) (72). The six stages included: 1) familiarization with the data, 2) coding, 3) searching for themes, 4) reviewing the themes, 5) naming and defining the themes, and 6) writing up the report (72). However, this is not a linear process as it may seem, in that, an iterative and recursive process was instead followed.

3.7.1. Familiarization with the data, coding, generating, naming and defining themes

The principal investigator listened to each audio recording and read and re-read all transcribed audio interviews to become acquainted with the data. The principal investigator also made initial notes about interesting features or potential codes and themes in the data. Additionally, the transcripts were reviewed for accuracy and completeness by comparing them with the audio recordings, and any missing sections or errors in transcription were corrected.

The transcripts (n=19) were imported into MAXQDA software (version 2020), and coding was done by the lead researcher and another researcher from Makerere University using thematic content analysis (73). The first step in the analysis was to look at the participants' own words and phrases without preconceived notions or classification. We then examined the language used by each participant in light of the CFIR framework's five domains: the intervention, inner setting, outer setting, the individuals involved and the implementation process. To ensure the reliability and

credibility of the research analysis, the two researchers (The lead researcher and the Makerere University researcher) developed the themes by reading the transcripts independently to establish inter-coder agreement (74). After the initial analysis, this two-member team met to discuss the themes generated independently and reach an agreement on the themes and sub-themes.

Once the agreement was reached on the themes, the transcript texts and quotes were grouped into the various themes. Following the generation of themes, the principal investigator used a reflexive approach to identify similarities or differences between the CFIR framework's five domains and the barriers and or facilitators of implementation outcomes among index tuberculosis case contacts in rural Mbarara district, Uganda. This iterative and recursive process provided space for reflectivity and ensured the credibility of the research findings. The themes were then defined and further refined to reflect each of the five CFIR domains in the results section below.

CHAPTER 4: RESULTS

This chapter presents the study findings. The chapter begins with a description of the demographic characteristics of the health workers who were interviewed. This is followed by qualitative findings, including quotes from the interviews. Finally, the results are presented under three themes that emerged from the analysis—intervention-related factors, health system factors and contextual factors.

4.1. Demographic characteristics of the participants

Nineteen participants took part in semi-structured interviews giving a response rate of 100%, 21.1% (n=4) of whom were male (Table 2). The sample comprised five clinical officers (26.3%), five nurses (26.3%), six CHWs (31.6%) who conduct community TB interventions, one laboratory technician (5.2%) and two district TB supervisors (10.5%). Most participants (56.1%; n=8) had above three years' experience in offering TB care.

Clinical officers were paramedics with a diploma in clinical medicine, while nurses had either a bachelor's degree in nursing, diploma, or nursing certificate. CHWs were lay health workers deployed at the village level to support community TB interventions. Laboratory technicians had a diploma in laboratory sciences, while district TB supervisors held a diploma in nursing and a clinical medicine diploma.

Table 2: Characteristics of the participants

Variable	**Label**	**Frequency (n)**	**Received TB Specific training (%)**
Sex	Male	4	50
	Female	15	87
Job title	Clinical officer	5	100
	Nurse	5	80
	CHW	6	67
	Laboratory technician	1	0
	District TB and Leprosy Supervisor	2	100
Experience in TB care	Less than one year	5	50
	1 to 3 years	6	83
	Above three years	8	100

4.2. Barriers and facilitators of TB contact investigation coverage

A reflective thematic analysis of the data gave rise to three themes; health system, contextual and intervention-related factors. The barriers and facilitators identified under each of the three themes are shown in table 3. The health system factors arose under six sub-themes in line with the WHO health system building blocks: Human resource, commodities, service provision, leadership and coordination, funding and health information systems. The contextual factors fell under four sub-themes: geographical, social and cultural, economic, and policy-related factors. The last theme (intervention-related factors) covered issues affecting TB contact investigation related to the intervention itself.

Table 3: Overview of barriers and facilitators of TB contact investigation coverage

Theme	Sub-theme	Barrier or facilitator	Description
Intervention related factors	Complexity of the intervention	Barrier	Disruptiveness of TB contact investigation to other interventions High airtime requirements (for phone calls)
	Awareness of the intervention	Facilitator	High awareness about TB contact investigation
Health system factors	Human resource	Barrier	Shortage of staff
		Facilitator	Adequate knowledge of TB contact investigation
	Commodities	Barrier	Lack of PPE commodities Stock-out of GeneXpert cartridges Shortage of airtime for communication
		Facilitators	Availability of telephone for communication Presence of a motorcycle at the health facility to aid transportation.
	Service provision	Barrier	Refusal of laboratory personnel to test sputum in fear of COVID 19 infection. TB support left to the implementing partners
	Leadership and coordination	Facilitator	Quarterly performance review meeting with stakeholders On-job training of health workers Engagement of crucial district stakeholders Guidelines are easily accessible online on WhatsApp TB team WhatsApp group for sharing information
	Funding	Barrier	Inadequate, irregular and delayed funding
	Health information	Facilitator	Availability of reporting tools
Contextual factors	Geographical factors	Barrier	Rugged terrain and poor road network
	Socioeconomic factors	Barrier	Poverty Patients lack phones where patients can be contacted TB related stigma Fear among patients to disclose that they are coughing.
	Policy related factors	Barrier	COVID-19 national lockdown hindered community household visits
		Facilitator	Availability of updated operational guidelines for TB contact investigation

Each of the themes is described in detail below.

4.2.1. Intervention-related factors

Intervention related factors were also found to hinder TB contact investigation. Three CHWs reported that TB contact investigation was disruptive to other existing interventions such as immunization and antenatal care. They had assignments at the health facility and were supposed to visit index TB patients in the community for contact investigation. Therefore, some health interventions such as immunization, antenatal care and HIV care were undone as health workers left for community home visits.

> *"…it interferes with other programs… Now I am here working at the health facility, collecting sputum, screening and… I have many patients attending immunization, antenatal, ART (HIV clinic), and I am the one who works on them too. And after that, I want to go and do contact tracing… Sometimes I ignore some of the activities so that I spare some time to go and do contact tracing in the community"* ***(CHWs 1, 4,5, BHCIV, BWHCIV, June 2020)***

Another challenge was that TB contact investigation requires multiple phone calls to different patients or contacts. At times, some patients are given appointments to come to the health facility but do not come. Health providers face challenges making such phone calls because of the enormous airtime demands of this intervention. For example, a single call to a patient can cost between one to 100 Ugandan Shillings).

"…some of these contacts need to be contacted on the phone several times because someone tells you he is coming tomorrow; tomorrow comes, and that person does not come. And the person keeps giving appointments without coming. And we do not have all that airtime…" ***(CHWs,2,5 BHCIV, KHCIV, July 2020)***

As a facilitator, 16 of the 19 participants interviewed reported that they knew about the intervention. They had engaged in relevant programs to improve uptake, such as enlisting household contacts, home visits, screening, and sputum collection.

"Supposing we have a TB patient. We ask if there is anyone coughing (in the household). We tell them the signs and symptoms of TB, and we ask if anyone is experiencing such. And in case anyone is coughing, we always go with all the necessary things that we need for that visit, such as sputum mugs. So if some people are coughing, we pick their samples and bring them to the lab (laboratory) for testing." ***(Nurse 3, KHCIV, July 2020).***

4.2.2. Health system factors

4.2.2.1. Human resource

The shortage of staff to conduct community visits and TB contact investigation was also reported by nurses and CHWs as a challenge. Sometimes, only one person goes for community visits, and they cannot complete all the tasks they are supposed to do.

"…sometimes there is a lack of manpower because…the health workers are not enough at the facility, so you find that only one person is going for that contact tracing, and the work there is huge, and that person cannot do all the work alone. So, most of the things are not done. They do part of the work and leave out some" ***(Enrolled nurse, KHCIV, CHW 5, BHCIV, July 2020).***

4.2.2.2. Commodities and equipment

Commodities for TB contact investigation were a prominent sub-theme, giving rise to two main challenges: (1) lack of toolkits for TB contact investigation, (2) lack of GeneXpert equipment and (3) stock-out of GeneXpert cartridges. The two facilitators arising from this theme were: (1) availability of a motorcycle to support transportation and (2) presence of phones loaded with airtime for scheduling household visits.

First, CHWs reported the lack of tools for community visits, especially during adverse weather conditions. Some CHWs and health workers said they lacked most of these essential tools.

"At times you go to a difficult place…in a rainy season…, you climb a hill while it is raining on you. You do not have an umbrella; you do not have boots or a bag to carry the stuff (materials)…" ***(CHW 5, BHCIV, June 2020).***

Furthermore, health facilities run short of infection prevention materials for home-based contact screening, such as masks and gloves, which increases the risk of acquiring TB and other infectious diseases and discourages them from doing community TB contact tracing.

"…if you find that even the person going to screen people for TB does not have a mask, the person does not have gloves, that means it is risky for that person. Because he or she could also get TB", ***(Clinical Officer 1, KHCIV, June 2020)***

Second, some health facilities lacked GeneXpert equipment because the machine is stationed at one hub laboratory in the district. This increases the results turn-around time, compromising early TB diagnosis and treatment and affecting TB contact investigation coverage. In some cases, health workers spent up to two months waiting for GeneXpert results.

"…if the government could help us and get us a GeneXpert machine here, it would be easier, and I think at a level of a Health Centre IV, we have the capacity to run it." ***(Clinical Officer 2, BHCIV, July 2020).***

"And we have a challenge with hub riders… Sometimes, the hub riders take sputum samples to Mbarara, and if they do not go back to pick the results, you will never see them. And you end up spending around two months without results" ***(Clinical Officer 2, BHCIV, July 2020).***

In addition, health facilities that operate GeneXpert equipment occasionally run short of cartridges which hampers TB evaluation and diagnosis. At times health facilities spend about two months without cartridges, and health workers are notified not to send sputum samples for analysis which negatively impacts coverage of contact investigation.

"…sometimes, there are no GeneXpert cartridges; you find that we are not doing GeneXpert (tests) because cartridges are finished…, at times we take like a month or two without cartridges and…that is not good…, the lab people tell us, 'do not send samples this month, we do not have (cartridges)', which means we are missing people (patients)." ***(Clinical Officer 1, BWHCIV, July 2020).***

The availability of a motorcycle to aid transportation of health workers to the community during community visits was reported as a major facilitator. This made transport cheaper because they only needed to fuel the motorcycle to be able to travel.

"We have a health facility motorcycle, which does not force us to put in a lot of money... We just consider the distance we are covering and then put in fuel and move, which is easier than getting a boda-boda [motorcycle taxi]." ***(CHW 3, BHCIV, June 2020).***

Also, health facilities had phones loaded with airtime to facilitate immediate communication of sputum results from the referral laboratory to lower laboratories.

"For GeneXpert, when you send the samples like today, they examine them, and if there is a positive, they call you (on the phone) immediately…" ***(DTLS2, MD, June 2020)***

4.2.2.3. Service provision

Some CHWs reported that the large health facility catchment area made it more difficult for field teams to deliver contact investigation services to distant households. As a result, contacts of index TB cases from remote places were instead asked to come to the health facility for further evaluation.

> *"Bugamba is a big sub-county; people come from distant areas, even neighbouring districts. And of course, as a health worker, you cannot reach every homestead. So, some (contacts) are called to come to the health facility. But because of the long distances, some fail to come."* ***(CHW 5, BHCIV, July 2020).***

Some places have poor roads that are impassable during the rainy season, thus affecting service delivery. In such circumstances, health workers use a boda-boda (motorcycle taxi) to a certain point and then walk the remaining distance. Sometimes the terrain is hilly and exhausting, which discourages teams from doing community visits.

> *"When it rains, then you will not go there because it is too slippery for a boda-boda (motorcycle taxi) to take you, so you have to climb an endless hill. Those are the challenges we are facing. Some are hard to reach areas"* ***(Clinical officer 3, KHCIV, July 2020).***

4.2.2.4. Leadership and coordination

The DTLSs reported that leaders at the Ministry of Health had neglected the planning, coordination and funding of TB interventions, including TB contact investigation. This

role was left to implementing partners, usually local and international Non-Governmental Organizations (NGOs), which negatively impacted the TB program.

> *"Also, The Ministry of Health has deliberately left this work (TB contact investigation) …to implementing partners, and it has killed everything. And in that line, I think we can eradicate TB, but if the government is putting in (effort), not leaving this disease for the implementing partners."* ***(DTLS 1, MD, July 2020).***

Also, participants reported that implementing partners have different priorities. These organizations mainly focus on HIV interventions and less on TB. Therefore, it is challenging to divert partners from their preferences and focus them on district priorities since they are often guided by their funders.

> *"They tell you their priority is HIV, and you cannot shift them. They have their …operational guidelines that you cannot change."* ***(DTLS 2, MD, July 2020).***

TB contact investigation guidelines were reported as both a barrier and facilitator. While the DTLS reported that guidelines were available and shared electronically on WhatsApp with health facility teams, some health workers reported not having them.

> *"We have TB contact investigation guidelines that were released in March 2019. We also have TPT (TB Preventive Treatment) guidelines, which we normally follow when we are initiating the eligible contacts…on TPT..."* ***(DTLS 1, MD, July 2021).***

"…we do not have guidelines" ***(CHW 1, KHCIV, July 2020)***

Under facilitators, the DTLSs reported that they had access to knowledge and information through training on various aspects of TB management, including TB contact investigation. The DTLS also used various platforms such as quarterly district performance review meetings to train health workers on TB contact investigation. As a result, CHWs reported that the training had given them adequate knowledge, skills and the confidence to conduct contact investigation activities.

"Even in meetings, we talk about contact tracing and investigation. Because for us we do meetings quarterly, all those meetings we…include a training in contact tracing and investigation" ***(DTLS 1 and 2, MD, July 2020).***

"I fully understand what to do. It is easy for me to reach out to those people because I can convince them. I have already obtained the skills to dig deep into their secrets while doing counselling." ***(CHW 5, BHCIV, July 2020).***

The district leadership also played a critical coordination role in engaging district-based stakeholders and formally appointed internal implementation leaders in supporting tuberculosis activities. In addition, the district-based stakeholders provided financial support for TB contact investigation and sponsored radio airtime for awareness creation.

"Other stakeholders are working hand in hand with the government and our implementing partners. I see them working as a team to sponsor airtime on radios to create awareness and also give some financial assistance." ***(Clinical Officer, BWHCIV, DTLS 1, MD, July 2020).***

Some participants reported that the district established favourable communication networks at district and health facility levels, facilitating efficient communication of guidelines, reference materials and patients' results. For example, the district had a WhatsApp group specifically for the district TB team to share information and monitor district activities.

"…we have a WhatsApp group of all the in charges and TB focal persons, where we discuss TB management and…share guidelines, so whoever needs guideline in TB management, he just goes there" ***(DTLS1, MD, June 2020)***

In addition, health workers and CHWs reported that the district and health facilities are networked with other NGOs and community-based organizations. These organizations support the implementation of TB contact investigation and other health interventions. The primary implementing partner was Regional Health Integration to Enhance Services in South Western (RHITES-SW) Uganda, which supports the district with transportation and materials while doing household visits.

"…RHITES-SW provides us with materials to use, like carrier bags. They provide us with transport to do contact tracing and the information. They normally update us on each and everything that is current in contact tracing and investigation" ***(Clinical officer 1, MD, July 2020)***

4.2.2.5. Funding related challenges

There were multiple funding challenges at national, district and health facility levels. Funding for TB contact investigation was provided through the Primary Health Care grants released from the Ministry of Health to public health facilities. Additional funds for contact investigation come from a USAID funded program for enhancing HIV and TB services in South Western Uganda.

The national-level funding challenges included low prioritization of TB contact investigation in the budgeting process. Health workers reported that TB was not considered a priority by the Ministry of Health which led to underfunding of the NTLP and eventually leading to underfunded TB work at district and health facility levels. TB interventions were not integrated into the annual budgeting processes like other interventions. Malaria and sanitation interventions received funds while TB remained unfunded since 2014. The DTLS reported that the sanitation program was prioritized and funded better than the TB program because of the advocacy by the sanitation program.

> *"…I think if the government says 'let us fight this disease', they need to put in (funds). Let them consider TB across the board. Let them budget for it like the way they budget for other conditions. Malaria is budgeted for. Sanitation…receives money every quarter. But it is like six years, since 2014 when there was money for TB…and only for one quarter"* ***(DTLS 1, MD, July 2020).***

The DTLSs reported insufficient funds for TB support supervision at the district level, which limited the amount of time the district TB supervisor spends in each health facility for supervision visits. Eventually, the quality of the supervision was compromised because teams did not have sufficient time and resources to train, mentor and supervise health facility teams adequately.

> *"Because of the funds being little, we are forced, like in a day, to move to about four facilities. Remember, in TB, there are six indicators that you need to focus on and get to understand what the problem is. So, you find we do not have sufficient time to spend in the facility and support it. So that is the challenge that we are getting."* ***(DTLS 1 and 2, MD, July 2020).***

Health facility level funding challenges included delayed reimbursement of funds and inadequate funds for conducting home visits. In some cases, health facilities rely on NGOs for extra funds to conduct contact investigations because of insufficient funds from the Primary Health Care (PHC) fund.

> *"…but when you do not have that NGO, things are challenging because you know that PHC money cannot be enough. You find that the PHC money is for only two patients, yet you have like six of them. So, when you do not have that money from NGOs, you cannot do it smoothly."* ***(DTLS 2, MD, July 2020)***

Some participants from the health facility level reported that they used their own money to trace index TB contacts; however, this money takes a long time to be

refunded. Some participants even had a pay gap of about five months which lowered their morale to continue with community visits.

> *"Most of the cases we use our own money… you want to do your job, but transport facilitation! Even…when they decide to refund it (money), it takes so long…for example, since January we have never got that transport* (money)*. We did contact tracing in January, February, March, April and May; we gave them reports, and they see that we are working, but we do not see our transport (money)"* ***(Clinical Officer 1,3,4 KHCIV, BHCIV, BWHCIV, July 2020).***

4.2.2.6. Health information system

One barrier of late submission of reports was reported under health information systems. The clinical officer, who also doubled as the facility TB focal person, said that TB contact investigation reports were submitted late because they must wait for an opportunity when someone is going to the district headquarters, which causes a delay in submission.

> *"sometimes, since we are sending the reports to Mbarara, they reach late because of transport issues. It becomes hard for someone to send the report since you cannot get any transport, so you get someone going to Mbarara, give them the reports, and tell that person where they should be delivering the reports. So, it also takes a bit of time"* ***(Clinical Officer 1, KHCIV, July 2020).***

Data use by the district health team came as a facilitator. Health workers reported quarterly performance and reflection meetings where all stakeholders discussed their performance and challenges across the different technical areas, including TB.

> *"…we normally have the district stakeholders meeting, where they (external stakeholders) normally come here, and we discuss performance in different areas - MCH (maternal and child health), HIV, also TB is given a platform. We tell them about our challenges."* ***(DTLS 1, MD, July 2020)***

4.2.3. Contextual factors

4.2.3.1. Geographical factors

Clinical officers, CHWs and the DTLS reported that some patients came from hard-to-reach areas characterized by rugged terrain where vehicles or motorcycles cannot reach. This makes it hard for health workers to visit such communities for TB contact investigation.

> *"…for those people who come from hard-to-reach areas, going to those homes is quite challenging. Sometimes we reach a point of walking on foot because we cannot reach there using a car or a motorcycle. So, we have to climb a steep hill to look for those patients"* ***(Clinical officer 3 BCIV, CHW 5 BHCIV, DTLS1 MD, June 2020).***

4.2.3.2. Socioeconomic factors

The stigma associated with TB was reported as a common challenge by all participants in this study. For this reason, index TB patients preferred not to be visited at home by a health worker out of fear of being stigmatized if neighbours and other community members found out that they had TB. Some index TB patients even tried to evade being visited by providing wrong telephone numbers and physical addresses to health workers. In addition, patients with TB and HIV have an increased fear of disclosing their status because there is a misconception that every TB patient has HIV.

> *"…some patients give us wrong telephone contacts, we call the number, it is not on, or a different person picks it. So, we fail to trace that person. Some fear health workers going to their homes. Mostly when the index TB patient is also HIV positive, they do not want people in their villages to see any health care worker coming to their home because they may identify them"* ***(CHW 2, KHCIV, July 2020).***

> *"Like you see people having stigma for HIV, some people with TB also have that stigma—that fear of being tested for TB. That if they are found positive (for TB), they are going to start TB drugs. And there is still a mentality that if someone has TB, then that person also has HIV"* ***(Clinical Officer 1, KHCIV, July 2020).***

Poverty among index TB patients was also found to be a challenge hindering TB contact investigation. TB patients and the contacts lack funds to transport them to the health facility for assessment, diagnostic testing and treatment. Hence, health workers sometimes take sputum samples in the community and transport them to the health

facility for testing. However, this was not possible in some cases, and some contacts are left undiagnosed, which perpetuates community TB transmission.

> *"They do not have money to come (to the health facility). At times you reach home and find that they cannot manage on their own, and the distance there is long. Now that is where we get challenged. Because we first take sputum from him and bring it this side, then get results. If you find that he is positive, of course you have to go back and start him on treatment from home, which makes the whole process very long."* ***(CHW 1, KHCIV, July 2020).***

> *"Sometimes, people come from those distant places; you know these families from our humble background. They do not have transport; you find someone has not taken supper; he is going to walk a distance of two miles. So they just say, 'no, I am not going'; they just remain at home..."* ***(CHW 4, BWHCIV, July 2020).***

Since they cannot afford a cellphone, some index TB patients do not have telephone contacts. This barrier makes it impossible to reach them when it comes to arranging house visits.

> *"There are some people whom we test, and after them being positive, they do not have phone contacts"* ***(Clinical officers 1 and 2, BWHCIV, July 2020).***

4.2.4.3. Policy related factors

The COVID-19 lockdown policy was reported as a barrier to contact investigation. Due to the lockdowns, some health workers and TB patients could not access health facilities because of strict measures like a halt on public and private transportation. This policy affected the mobility of the health workers and patients to the health facility and compromised TB contact investigation efforts.

> *"Now with corona (COVID-19), we would come here and not find any patient or health worker because we did not have transport means during the lockdown. Most of our people stayed in Mbarara (about 30km away). Even if you had your own motorcycle, they would not allow you to ride it..."* ***(Clinical officer 1, KHCIV, July 2020).***

The COVID-19 pandemic also had other associated challenges, such as stigma among patients and health workers. Some TB contacts were afraid to report cough in fear of being suspected of having COVID-19 and having to be quarantined. Also, COVID-19 has heightened the stigma associated with TB because the two conditions have similar symptoms. Health workers cannot tell who has COVID-19 or TB and, therefore, avoid anyone presenting with cough because they fear it might be COVID-19.

> *"…with this corona (COVID-19) period, when you ask someone if they are coughing, they will just look at you, because…they hear that when you are coughing, they are going to put you in quarantine. So, we are now getting a few people…"* ***(Clinical officer 1, KHCIV, July 2020).***

"Corona has also brought about stigma and caused TB to be as if it is forgotten…you know TB also has the signs similar to those for corona (COVID-19); someone presents with fevers, difficulty in breathing…even us health workers, we also fear it may be Corona (COVID-19)." ***(Nurse 4, BWHCIV, July 2020).***

Some laboratory staff also refused to test sputum samples because they worried that samples could contain COVID-19 and increase the risk of contracting the virus among the laboratory team.

"…nowadays because of COVID-19, they (laboratory staff) refuse to test the samples…they think the sputum samples might contain COVID-19." ***(CHW 5, BHCIV, July 2020)***

CHAPTER 5: DISCUSSION

This chapter includes an interpretation of the study findings in light of the existing evidence. The discussion of findings was based on the study aim, which was to investigate the barriers and facilitators of TB contact investigation among health providers in Mbarara district in South Western Uganda. The chapter also discusses how the study results can influence policy in TB contact investigation and the implications for current practice. Finally, the limitations to the study and mitigation strategies are also discussed.

This study explored factors that influence TB contact investigation coverage in three rural, primary health facilities in Mbarara District, South Western Uganda. The study is unique in its rural setting, unlike previous studies in Uganda and Kenya that have focused on urban settings (26, 33, 75). The barriers and facilitators identified in this study were diverse and covered all the five domains of the CFIR. Although some studies have used implementation research tools to identify the barriers and facilitators to implementing TB contact investigation, this is the first study to use the CFIR to explore the factors influencing TB contact investigation coverage in Africa.

The need to make multiple phone calls to schedule household visits with index clients and disruption of other services when workers undertake contact visits are barriers to TB contact investigation coverage. Rugged terrain and poor road networks made it difficult for health workers to access clients. Weaknesses in the health system, including lack of funding for TB contact investigations, insufficient availability of PPE, inadequate provision of GeneXpert equipment for testing, laboratory staff fear to test

sputum samples and staff shortages also adversely affected contact investigation. Poverty and TB- and COVID19-related stigma were also perceived as barriers.

Among health workers, the key facilitators were increased awareness of TB contact investigation, adequate knowledge of the Ugandan MoH guidelines, confidence in delivering the intervention and on-the-job training of health workers. In addition, the availability of a phone and transport to schedule and make household visits, respectively, were reported as facilitators. The support of key district stakeholders involved in TB contact investigations and quarterly data performance review meetings were also noted.

Barriers of TB contact investigation coverage

In line with the 2005 Guidelines from the US Centers for Disease Control and Prevention, this study suggests that TB contact investigation was complex and disruptive to other existing interventions (76). In general, TB contact investigation requires multiple staff to conduct; however, inadequate human resources make it a challenge in low-income countries like Uganda. For instance, participants reported that the same health workers who had assignments at the health facility were doing household visits, thus leaving work unfinished while on community visits. Similarly, TB contact investigation required making multiple phone calls to patients or their contacts, which requires a lot of airtime which is costly. These findings provide convincing examples of how intervention characteristics could stifle the implementation of an intervention, thus hindering the achievement of optimal coverage.

Health system barriers to TB contact investigation coverage have gained significant attention over the last five years (14, 33, 41). For instance, previous studies have explored how the health system components (human resources, health financing, leadership and coordination, health information systems, commodities and service provision) influence coverage of TB contact investigation. These factors were also found to hinder the implementation of TB contact investigation in this study. In addition, all these factors fall under the inner setting suggesting the critical role of this domain in implementing the intervention and increasing contact investigation coverage.

The health system barriers that emerged from this research were inadequate or irregular funding, human resource shortages, lack of PPE supplies (face masks, gloves, raincoats and gumboots), out of stock of GeneXpert cartridges and lack of airtime for communication. In addition, inadequate or inconsistent funding limited the frequency of the DTLS visits to health facilities for supervision and caused a delay in payment of travel and allowances to field teams, causing TB contact investigation operations to be hampered. In contrast, another study conducted in urban Kenya found that the TB program received sustainable funding for infrastructure and health workforce for contact investigation (41). Furthermore, this Kenyan study used the WHO health systems framework. It focused on the stakeholder perspectives of the barriers and facilitators to optimising TB contact investigation in Nairobi, the capital of Kenya. This funding disparity between rural and urban areas is because urban areas are funded better because of a higher TB prevalence (77).

Consistent with this study, three studies conducted in Botswana, Ethiopia and Uganda reported human resource shortages as a considerable hindrance to TB contact investigation coverage (14, 33, 43). In urban Uganda, health workers had other competing duties in the TB clinics; thus, they did not have sufficient time for community-level activities, including household contact tracing (33). In this study, sometimes only one health worker was available for community visits, and they could not complete multiple tasks such as health education, screening, sample collection, HIV testing and documentation in the registers. The staff shortage is partly attributed to a small number of staff trained in TB and assigning them to other units outside the TB unit (14).

Another significant barrier identified in this study was a lack of PPE materials such as masks, gloves, raincoats and gumboots for health workers to protect themselves against TB and other infectious diseases (such as COVID-19). Health staff were hesitant to conduct household contact investigations without wearing masks and gloves to avoid contracting TB. Similarly, protective gear, such as raincoats and gumboots, to be used in harsh weather conditions; were not provided to health workers. There is limited literature on the influence of PPE materials on TB contact investigation coverage. These findings indicate that the supply chain management system for essential infection control materials is weak. These results will guide the next steps in developing strategies to secure adequate PPE materials and support the supply chain for these commodities.

The context within which an intervention is implemented is recognized as a significant determinant of implementation success (49). Contextual factors refer to issues about

a person or their environment that can positively or negatively affect the delivery of an intervention (49). Socioeconomic, policy-related, and geographical barriers emerged as contextual barriers in this research.

The socioeconomic factors include poverty, lack of phones where patients can be contacted to confirm the appointment of household visits, stigma, and fear of reporting cough in fear of being labelled to have COVID-19.

In Botswana, Kenya, Ethiopia, and Uganda, the stigma associated with tuberculosis has been reported as a barrier to TB contact investigation. (14, 26, 33, 43). Although these studies did not specifically focus on TB contact investigation coverage, stigma hindered household visits because index TB patients avoided home visits by health workers out of fear of their status being disclosed and discrimination, which could eventually affect coverage of the intervention. An important observation in our study was that stigma was worsened by the misconception that every TB patient has HIV. These findings imply that TB related stigma is still deeply entrenched in rural and urban communities in Uganda. Interventions to mitigate stigma may be valuable for scaling up TB contact investigation coverage.

The COVID-19 pandemic has also aggravated stigma. Tuberculosis and COVID-19 have common respiratory symptoms (cough, fever, and breathing difficulties), making it difficult to distinguish the two. As a result, health workers and the general public avoided anyone with a cough in fear of contracting COVID-19. Consequently, this stigma could promote social isolation, which may cause people to hide the infection to avoid being discriminated against, reduce health-seeking practices and discourage

them from adopting healthy behaviours (78). The findings from this study contribute to the growing body of evidence about the relationship between COVID-19 and TB contact investigation.

The COVID-19 lockdown policy implemented in 2020 by the Government of Uganda posed significant challenges to TB contact investigation efforts. Both health staff and patients could not access health facilities due to stringent lockdown measures, including travel restrictions and public and private transportation prohibitions. Additionally, health providers could not conduct home visits to screen the contacts. Similar findings were found in another study on the impact of COVID-19 on TB programs in Western Pacific nations (79). Other COVID-19 related problems encountered in the Western Pacific study included a change in priorities towards the COVID-19 response as demonstrated by the relocation of TB program staff to the COVID-19 response and a reduced willingness of patients and contacts to visit health facilities (79). Therefore, innovative strategies are required to accelerate TB contact investigation in the context of the COVID-19 pandemic.

As reported by Cattamanchi et al., geographical challenges contribute to the failure of TB patients and contacts to present at health facilities for TB care (38). In their study, health workers reported that the physical remoteness of patients' homes from the health facility and the rugged terrain encountered during travel was a challenge (38). Likewise, in this study, health workers reported that some index TB patients and contacts came from distant and challenging areas with steep hills and poor road networks, preventing access to health facilities. This challenge was aggravated by

poverty because patients and contacts from the periphery of the county could not travel to health facilities because of high transport costs.

Facilitators of TB contact investigation coverage

All health workers interviewed in this study reported awareness of the intervention. They had even engaged in relevant programs to improve its uptake, including enlisting household contacts, home visits, screening, and sputum collection. In addition, the clarification of the various steps demonstrated health workers adhered to the organizational protocols for TB contact investigations. The increased awareness and fidelity to the guidelines may be attributed to developing and disseminating local contact investigation procedures through training and electronic media such as WhatsApp. Conversely, a similar study conducted in rural Ethiopia found that awareness and adherence to the guidelines were poor because of a lack of refresher training (14).

Health system facilitators of TB contact investigation that emerged from this study include provider knowledge, holding performance review meetings at the district level and engagement of district stakeholders to obtain their support.

In contrast to other studies in Uganda, Ethiopia and the USA, provider knowledge and confidence (self-efficacy) worked as facilitators in this study. Staff involved in TB contact investigation had received on-the-job training on various aspects of TB management, including contact investigation, diagnosis and management (14, 33, 80). In this study, health workers reported that they had the knowledge, skills, and

confidence to conduct TB contact investigations successfully. These results are partly attributed to the quarterly district performance review meetings in which an orientation on TB contact investigation was done and guidelines shared with health workers.

Reflection and evaluation in TB contact investigation were demonstrated by Karamagi et al. in a Quality Improvement study to improve case finding in northern Uganda (81). A review meeting was held to discuss progress on active case finding and develop scale-up plans for the intervention (81). Similarly, this study found that quarterly district review meetings were held to discuss district and health facility performance, challenges and improvement strategies in various program components, including TB contact investigation. This was a facilitator because these meetings were used to review quarterly TB performance and develop action plans to improve multiple TB indicators, including TB contact investigation.

Engagements with individuals involved in implementation were also reported as a facilitator of TB contact investigation coverage. For example, district-based stakeholders such as NGOs, health workers, TB focal persons, and health facility managers were engaged in regular meetings during planning, implementation, and reporting. These engagements were valuable for developing work plans, identifying funds for activities, reviewing district performance, and executing activities. The district leadership and stakeholders were, therefore, able to monitor implementation. These results corroborated findings from Uganda and Nigeria, which demonstrated a multi-stakeholder approach in increasing the yield of TB cases from TB contact investigation (82). Thus, this study highlights the importance of engaging various stakeholders involved in executing contact investigations.

Another facilitator was the presence of registers for recording data from TB contact investigation activities. These registers were essential in compiling monthly and quarterly reports on TB contact investigations and using data for quality improvement programs to increase intervention coverage. These findings are close to those obtained in Ethiopia, where health workers were given the tools they needed to collect contact investigation data (14). These findings are explained by the consistent support in printing and distributing Health Management and Information System (HMIS) tools by health development partners with funding from the US President's Emergency Plan for AIDS Relief (PEPFAR) (83).

One contextual facilitator arose from this study. Health workers and DTLSs both reported the existence of guidelines as a facilitator in TB contact investigations. Contrary to other implementation research studies conducted in Uganda and Kenya (33, 41), which found that health workers lacked operational guidelines for TB contact investigation, this study found that health workers had the most recent and updated Ministry of Health guidelines. These guidelines were distributed to health facility teams using the WhatsApp mobile app, which was widely used in the district. Training health workers to adhere to guidelines has also been shown to increase TB contact investigation coverage (41).

5.3. Strengths and limitations of the study

This study has several strengths. First, we included various health provider categories at different levels of the district healthcare system, including community, health facility

and district level stakeholders, to obtain different views from the participants. Second, this study is among the first few studies to use implementation science methods to investigate the rural perspective of the challenges and enablers of TB contact investigation coverage. Third, the CFIR implementation science framework (7) is another strength because the constructs helped identify and describe the factors required to improve coverage—a key indicator for implementation success. Finally, we used this framework for developing semi-structured interview guides and interpretation of study findings.

Some weaknesses were also observed. First, index TB patients and their contacts were not interviewed; therefore, some information on the challenges and enablers of contact investigation coverage from the patients' perspective may have been missed. Second, data collection was conducted during the COVID-19 lockdown, and some health workers were inaccessible, especially laboratory personnel involved in pandemic control activities at the time. Consequently, the laboratory may have challenges that were not identified in this study. Third, the COVID-19 pandemic may have intensified some challenges which were not so pronounced before the pandemic. Finally, the generalizability of our results to other geographical locations may be limited because this study was conducted in one district in Uganda, which gives it a narrow scope. However, we included three health facilities in different counties, which may improve transferability to other settings.

5.4. Applicability of the Consolidated Framework for Implementation Research framework

The CFIR served as an essential tool for developing the semi-structured interview guide and identifying the factors affecting TB contact investigation. Most of the themes for both barriers and facilitators emerged from the inner setting (Table 4). This finding suggests that the inner setting is the most critical construct in contact investigation; therefore, strategies for improving contact investigation coverage in the rural setting should be targeted to this domain.

Table 4: Domains of the CFIR and factors affecting TB contact investigation coverage

CFIR Domain	Barrier or facilitator	Explanation
Characteristics of the intervention	Barrier	Disruptiveness of TB contact investigation to other interventions. High airtime requirements (for phone calls).
Inner setting	Facilitator	TB team WhatsApp group for sharing information Availability of telephone and motorcycle at the health facility
	Facilitator	Guidelines are easily accessible online on WhatsApp
	Barrier	TB support left to the implementing partners
	Barrier	Inadequate, irregular and delayed funding Lack of PPE commodities for TB contact investigation Stock-out of GeneXpert cartridges Shortage of human resource Shortage of airtime for communication
Outer setting	Facilitator	Availability of updated operational guidelines for TB contact investigation
	Barrier	Rugged terrain and poor road network
	Barriers	National lockdown hindered community home visits for household contact investigation Fear among patients to disclose that they are coughing. Refusal of laboratory personnel to test sputum
Individuals involved	Barrier	TB related stigma Poverty Lack of phones where patients can be contacted
	Facilitator	On-job training of health workers Adequate knowledge of contact investigation
Implementation Process	Facilitator	Quarterly performance review meeting with stakeholders
	Facilitator	Engagement of crucial district stakeholders

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

This study explored health providers perspectives of the barriers and facilitators of TB contact investigation in rural Mbarara district, South Western Uganda. The challenges identified from this study included the need to make multiple phone calls to schedule household visits with index clients and disruption of other services when workers undertake household visits. Similarly, the rugged terrain and poor road networks made it difficult for health workers to access clients. Health system gaps, including the shortage of funds for TB contact investigations, insufficient PPE, inadequate GeneXpert equipment for testing and laboratory staff fear to test sputum samples, and staff shortages also emerged as challenges to contact investigation coverage. Poverty, TB- and COVID19-related stigma were also perceived as barriers.

The key facilitators were increased awareness of TB contact investigation, adequate knowledge of the Ugandan MoH guidelines, confidence in delivering the intervention and on-the-job training of health workers. The availability of a phone and transport to schedule and make household visits, respectively, were noted as facilitators. The support of key district stakeholders involved in TB contact investigations and quarterly data performance review meetings also emerged as facilitators.

This study demonstrated the unique differences in the challenges affecting the rural and urban settings regarding tuberculosis contact investigation. In contrast to studies conducted in urban Uganda and Kenya, inadequate funding, insufficient PPE and geographical barriers such as rough terrain, poor road network and long distances

from the health facility negatively impacted TB contact investigation coverage (33, 41). In addition, some factors such as TB related stigma and health worker shortages were cross-cutting with those found in urban places in Uganda.

This study contributes to the existing evidence on the barriers and facilitators of TB contact investigation. We provide a context-specific exploration of the factors influencing TB contact investigation coverage in a rural setting. The factors have been identified at multiple levels using the domains and constructs of the CFIR, providing evidence to guide policy formulation and development of implementation strategies mainly targeting the hard-to-reach rural settings.

6.2. Recommendations

A regular and sustainable funding mechanism is critical for successfully implementing and achieving TB contact investigation coverage targets. Given that Uganda declared TB a public health emergency in November 2019, the Ministry of Health should explore opportunities to secure adequate funding for effective and long-term TB contact investigation, especially in rural, hard to reach communities. Similarly, the NTLP and partners should evaluate the funds flow system to eliminate bottlenecks to delayed transport reimbursement for field teams involved in TB contact investigation activities.

Regarding the challenges of rugged terrain, poor road network, long distances of patient homes from the health facility, we recommend tailor-made interventions for the rural hard to reach areas instead of the current “one size fits all” approach to TB contact investigations. For example, in the Uganda Ministry of Health's current plan to

deploy 15,000 community health extension workers by 2020 (84), priority should be given to geographically hard to reach health facilities to enable health workers to access hard to reach areas that would require more time and resources.

This study also highlights the challenges stigma poses to TB control efforts. Therefore, we recommend that the NTLP develops individual and community health education and sensitization programs to pass on messages for reducing TB and HIV related stigma.

The Ministry of Health, NTLP and stakeholders involved in TB contact investigation should collaboratively strengthen all the health system elements to support TB contact investigation. For example, they should provide laboratory infrastructure to ease access to onsite GeneXpert testing, provide toolkits for field visits, fill staffing gaps at the health facility and community levels and conduct regular support supervision and monitoring.

From the onset of the COVID-19 pandemic, the Ministry of Health has redirected most of the resources to COVID-19, thus neglecting other health interventions, including TB contact investigation. Since both TB and COVID-19 control involve contact tracing, the NTLP should simultaneously explore strategies for integrating interventions to address the two pandemics.

Having identified the barriers and facilitators of TB contact investigation coverage, further research is needed to determine the effectiveness of potential implementation strategies for eliminating these barriers.

There is insufficient evidence on the disruptive nature of the COVID-19 pandemic to the achievement of optimal TB contact investigation coverage. Therefore, more research is needed to determine the impact of COVID-19 on TB contact investigation implementation outcomes.

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APPENDICES

Appendix 1: Plagiarism declaration form

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

FACULTY OF HEALTH SCIENCES

PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS

SENATE PLAGIARISM POLICY: APPENDIX ONE

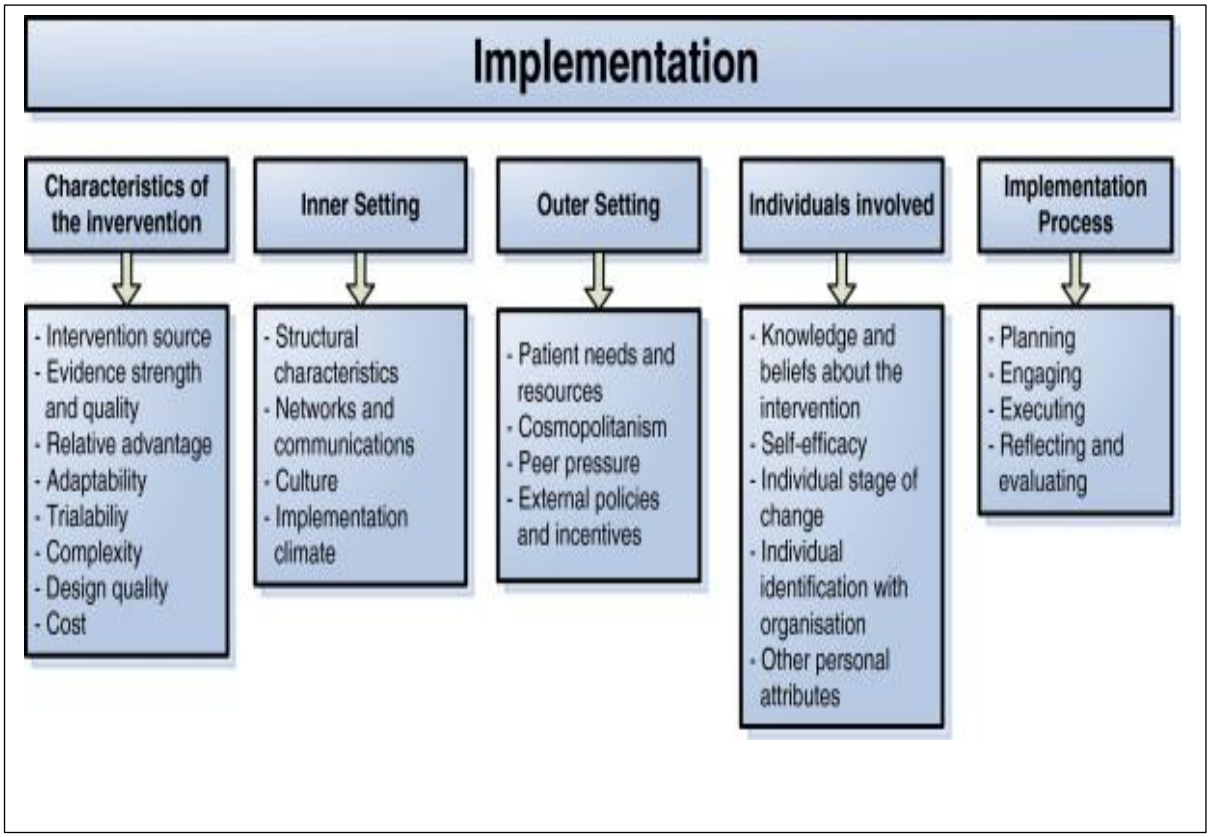
I Paddy Mutungi Tukamuhebwa (Student number: 1876351) am a student registered for the degree of MSc in Epidemiology (Implementation Sc) in the academic year 2019.

I hereby declare the following:

- I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong.
- I confirm that the work submitted for assessment for the above degree is my own unaided work except where I have explicitly indicated otherwise.
- I have followed the required conventions in referencing the thoughts and ideas of others.
- I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.
- I have included as an appendix a report from "Turnitin" (or other approved plagiarism detection) software indicating the level of plagiarism in my research document.

Signature:  Date: 20th April 2021

Appendix 2: The Consolidated Framework for Implementation Research



Appendix 3: Interview guide for the District TB and Leprosy Supervisor

Topic: Barriers and facilitators of investigation coverage among index TB case contacts in rural Mbarara district, Uganda.

Background information

1. Please describe your role, position and responsibilities regarding TB contact investigation in the district?
    a. How do you think people who have been diagnosed with TB affect the health of people living in the same household?
    b. What do you know about the program for TB testing among people in close contact with a TB patient?

Characteristics of the intervention

2. How does TB contact investigation work in this district?
3. Describe the implementation procedures or steps involved in TB contact investigation?
4. What aspects of TB contact investigation are working well in this district?
5. What aspects of TB contact investigation are not working well in this district?
6. What is being done in this district to address these challenges?

Inner setting

7. To what extent do you think you are ready to conduct TB contact investigation?
8. What training did you receive to equip you to do your job regarding TB contact investigation?
9. How well do you think the training prepared you to coordinate and supervise TB activities in the district?
10. To what extent do you think other activities may be affected because of TB contact investigation activities?
11. What information or materials regarding TB contact investigation are available at the district?
12. How easy or difficult is it to access these information materials?

13. To what extent do you receive the support of management to conduct TB contact investigation?

Outer setting

14. What other organizations or institutions are involved in TB contact investigation in this district?
15. What roles do these organizations play in TB contact investigation?
16. From your perspective, what factors encourage TB patients and their contacts to access TB contact investigation services in the district?
17. From your perspective, what do you think stops TB patients and their contacts from accessing TB contact investigation services?
18. What suggestions do you have to improve TB contact investigation coverage in this district?

Individuals involved

1. Who is involved in TB contact investigation?
2. To what extent do you feel confident that you can support health facility and field teams regarding TB contact investigation?
3. To what extent do you feel you have adequate knowledge about TB contact investigation?

Implementation process

4. What plan is in place for conducting TB contact investigation activities?
5. To what extent is TB contact investigation conducted according to plan in your district?
6. To what extent has the district set any targets for TB contact investigation?
7. To what extent are these targets monitored?
8. To what extent have you engaged the appropriate stakeholders involved in TB contact investigation?

Appendix 4: Interview guide for health workers

Topic: Barriers and facilitators of investigation coverage among index TB case contacts in rural Mbarara district, Uganda.

Background information

1. Please describe your role, position and responsibility in this health facility regarding TB contact investigation?
    a. How do you think people who have been diagnosed with TB affect people living in the same household?
    b. What do you know about the program for TB testing among people in close contact with a TB patient?

Characteristics of the intervention

2. How does TB contact investigation work at this health facility?
3. Describe the implementation procedures or steps involved in TB contact investigation?
4. What aspects of TB contact investigation are working well?
5. What aspects of TB contact investigation are not working well?
6. What are you doing to address these challenges?

Inner setting

7. To what extent do you receive the support of management (leadership) to conduct TB contact investigation?
    a. What kind of support do you receive, who gives the support and which office?
8. What kind of training did you receive to perform your job regarding TB contact investigation at this health facility?
9. How well do you think the training prepared you to offer these services?
10. What information materials regarding TB contact investigation are available at this health facility?
11. How easy do you think it is to access these materials at this health facility?

Outer setting

12. What are other organizations involved in TB contact investigation?
13. From your perspective, what factors encourage TB patients and their contacts to access TB contact investigation services?
14. From your perspective, what do you think stops TB patients and their contacts from accessing TB contact investigation services?
15. What suggestions do you have to improve TB contact investigation coverage at this health facility?
16. To what extent have guidelines or policies influenced your decision to conduct TB contact investigation?

Individuals involved

- Who is involved in conducting TB contact investigation activities?
- To what extent do you feel confident that you can conduct TB contact investigation activities?
- To what extent do you feel you have adequate knowledge about TB contact investigation?

Implementation process

17. What plan is in place for conducting TB contact investigation activities?
18. To what extent is TB contact investigation conducted according to plan in your district?
19. To what extent are other organizations or stakeholders engaged in TB contact investigation?
20. How do you report the information from TB contact investigation?
21. What challenges do you face concerning reporting?
22. To what extent does this health facility set and monitor targets for TB contact investigation?
23. To what extent do you think other activities or processes are affected because of TB contact investigation activities?

Appendix 5: Interview guide for community health workers

Topic: Barriers and facilitators of investigation coverage among index TB case contacts in rural Mbarara district, Uganda.

Background information

1. Please describe your roles and responsibilities regarding TB contact investigation?
    a. How long have you been involved in TB contact investigations?
    b. How do you think people who have been diagnosed with TB affect people living in the same household?
    c. What do you know about the program for TB contact investigation, i.e. testing TB among household members of people with TB?

Characteristics of the intervention

2. How does TB contact investigation work in this community?
3. Describe the implementation procedures or steps?
4. What do you find challenging about visiting households for TB contact investigation?
5. What do you think enables you to visit households for TB contact investigation?
6. How do people with TB and their household members treat you when you go for home visits?
7. How easy is it to find TB contacts at home and willing to be screened?
8. How easy is it to get household contacts to come to the health facility for investigation?
9. How successful have you been in tracking whether they come to the facility for evaluation?
10. What do you think should be done to address the challenges you have (if any)?

Inner setting

11. What training did you receive before you started conducting TB contact investigation activities?
12. To what extent do you feel you have the necessary knowledge and skills to visit households and screen contacts for TB?

13. What information or materials regarding TB contact investigation are available to you?
14. How easy do you think it is to access these information materials?
15. To what extent do you think other activities may be affected because of TB contact investigation activities?

Outer setting

16. From your perspective, what factors encourage TB patients and their contacts to seek TB contact investigation services.
17. From your perspective, what do you think stops TB patients and their contacts from accessing TB contact investigation services?
18. What suggestions do you have to improve TB contact investigation?

Individuals involved

19. To what extent do you feel confident that you can conduct community-based contact investigation activities?
20. To what extent do you feel you have adequate knowledge about TB contact investigation?

Implementation process

21. What plan is in place for conducting TB contact investigation activities?
22. To what extent is TB contact investigation conducted according to plan?
23. To what extent are other organizations or stakeholders engaged in TB contact investigation?
24. How do you report the information from community TB contact investigation activities?
25. What challenges do you face concerning reporting?
26. To what extent do you think other community activities or processes are affected by TB contact investigation activities?

Appendix 6: Approval by the Human Research Ethics Committee at the University of the Witwatersrand

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

R14/49 Dr PM Tukamuhebwa

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M200101

NAME: (Principal Investigator)	Dr PM Tukamuhebwa
DEPARTMENT:	School of Public Health Division of Epidemiology and Biostatistics Medical School University
PROJECT TITLE:	Barriers and facilitators of investigation coverage amongst index tuberculosis case contacts in rural Mbarara district, Uganda
DATE CONSIDERED:	31/01/2020
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Drs N Ndlovu and P Munyewende
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2020/03/11

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on the 3rd Floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.
I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to submit details to the Committee. **I agree to submit a yearly progress report**. When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **January** and will therefore reports and re-certification will be due early in the month of **January** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

20th March 2020.
Date

PLEASE QUOTE THE CLEARANCE CERTIFICATE NUMBER IN ALL ENQUIRIES

Appendix 7: Ethics clearance by the REC at Mbarara University of Science and Technology.

MBARARA UNIVERSITY OF SCIENCE AND TECHNOLOGY
P.O. Box 1410, Mbarara Uganda. Tel: +256 485433795; Fax: +256 4854 20782
RESEARCH ETHICS COMMITTEE
E-mail: sec.rec@must.ac.ug

Ref: MUREC 1/7

Date: **February 19, 2020**

Mr. Paddy Mutungi Tukamuhebwa
Postgraduate student

Re: **Submitted protocol on "Barriers and facilitators of investigation coverage among index tuberculosis case contacts in rural Mbarara District, Uganda" 17/12-19**

Type: [√] Initial Application
[ ] Protocol Amendment
[ ] Letter of Amendment (LOA)
[] Continuing Review
[ ] Material Transfer Agreement
[ ] Other, specify: _____

Mbarara University of Science & Technology
P. O. Box 1410, Mbarara
RESEARCH ETHICS COMMITTEE
18 FEB 2021
APPROVED
VALID UNTIL DATE SHOWN ABOVE

Reference is made to the above protocol which was resubmitted to the Research Ethics Committee for reconsideration and approval under expedited review process.

It is noted that you have addressed all the concerns earlier raised by the Committee.

I am pleased to inform you that your study has been approved for a period of one year from **February 19, 2020** up to **February 18, 2021.**

As Principal Investigators of the research, you are responsible for fulfilling the following requirements of approval:

1. All co-investigators must be kept informed of the status of the research.
2. Changes, amendments, and addenda to the protocol or the consent form must be submitted to the REC for review and approval **prior** to the activation of the changes. The REC application number assigned to the research should be cited in any correspondence.
3. Reports of unanticipated problems involving risks to participants or other must be submitted to the REC. New information that becomes available which could change the risk: benefit ratio must be submitted promptly for REC review.
4. Only approved consent forms are used in enrolment of participants. All consent forms signed by subjects and/or witness should be retained on file. The REC may conduct audits of all study records, and consent documentation may be part of such audits.
5. Regulations require review of an approved study not less than once per 12-month period. **Therefore, a continuing review application must be submitted to REC eight weeks prior to the above expiration date of February 18, 2021 in order to continue the study beyond the approved period.** Failure to submit a continuing review application in timely fashion may result in suspension or termination of the study, at which point new participants may not be enrolled and currently enrolled participants must be taken off the study.

6. You are required to register the research protocol with the Uganda National Council for Science and Technology (UNCST) for final clearance to undertake the study in Uganda.

The following is the list of documents approved in the application:

Document	Language	Version
Proposal	English	2
Data Collection Tool	English, Runyankore/Rukiiga	February 2020
Consent form	English, Runyankore/Rukiiga	February 2020

I wish you all the best.

Dr. Francis Bajunirwe
CHAIR,
MUST RESEARCH ETHICS COMMITTEE

Appendix 8: Approval by the Uganda National Council for Science and Technology

Gmail Tukamuhebwa Paddy <paddytmjwm@gmail.com>

HS569ES: Barriers and facilitators of investigation coverage among index tuberculosis case contacts in rural Mbarara district, Uganda.
12 messages

Research Management - UNCST <research@uncst.go.ug> 20 March 2020 at 21:53
Reply-To: Research Management <research@uncst.go.ug>
To: Tukamuhebwa <paddytmjwm@gmail.com>
Cc: Tukamuhebwa <1876351@students.wits.ac.za>

Uganda National Council for Science and Technology
(Established by Act of Parliament of the Republic of Uganda)

Dear Paddy Tukamuhebwa,

I am pleased to inform you that on **20/03/2020**, the Uganda National Council for Science and Technology (UNCST) approved the above referenced research project. The Approval of the research project is for the period of **20/03/2020** to **20/03/2021**.

Your research registration number with the UNCST is **HS569ES**. Please, cite this number in all your future correspondences with UNCST in respect of the above research project. As the Principal Investigator of the research project, you are responsible for fulfilling the following requirements of approval:

1. Keeping all co-investigators informed of the status of the research.
2. Submitting all changes, amendments, and addenda to the research protocol or the consent form (where applicable) to the designated Research Ethics Committee (REC) or Lead Agency for re-review and approval **prior** to the activation of the changes. UNCST must be notified of the approved changes within five working days.
3. For clinical trials, all serious adverse events must be reported promptly to the designated local REC for review with copies to the National Drug Authority and a notification to the UNCST.
4. Unanticipated problems involving risks to research participants or other must be reported promptly to the UNCST. New information that becomes available which could change the risk/benefit ratio must be submitted promptly for UNCST notification after review by the REC.
5. Only approved study procedures are to be implemented. The UNCST may conduct impromptu audits of all study records.
6. An annual progress report and approval letter of continuation from the REC must be submitted electronically to UNCST. Failure to do so may result in termination of the research project.

Please note that this approval includes all study related tools submitted as part of the application as shown below:

No.	Document Title	Language	Version Number	Version Date
1	Letter of support from the University	English	1	
2	Informed consent form for Health Workers	English	1	10 November 2019

3	Informed consent form for CHWs	English	1	10 November 2019
4	Informed consent form for DTLs	English	1	10 November 2019
5	Informed consent form for DTLs	English	1	10 November 2019
6	Interview guide for the DTLS	English	1	10 November 2019
7	Interview guide for Health workers	English	1	10 November 2019
8	Interview guide for Community HWS	English	1	10 November 2019
9	Interview guide for Community HWS	Runyankore	1	10 November 2019
10	Informed consent form for CHWs	Runyankore	1	10 November 2019

Yours sincerely,

Hellen Opolot
For: Executive Secretary
UGANDA NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Appendix 9: Administrative clearance the District Health Officer

Telephone:
Office: 04854-20002

MBARARA DISTRICT LOCAL GOVERNMENT
OFFICE OF THE DISTRICT HEALTH OFFICER
P. O. BOX 1,
MBARARA UGANDA

Our Ref: HEA/114/1

Date: February 13, 2020

The Chairperson
Human Research Ethics Committee
University of the Witwatersrand

LETTER OF SUPPORT FOR PADDY MUTUNGI TUKAMUHEBWA

Reference is made to the letter **Ref: MURE 1/7** dated **January 31, 2020** on the above subject matter.

In view of the above, this letter serves to support this research, "**Barriers and facilitators of investigation coverage among index tuberculosis case contacts in Rural Mbarara District, Uganda**". The research will be conducted in Bwizibwera HCIV - Rwanyamahembe - Kashari North – Mbarara District Local Government.

It is expected that his research will contribute to the understanding of tuberculosis contact investigation, its challenges and the enablers of TB services delivery in Mbarara District.

The purpose of this letter therefore is to affirm that **Mr. Paddy Mutungi Tukamuhebwa** who is a Postgraduate student will be supported to conduct his study with in Mbarara District.

Any support accord to him will be highly appreciated.

13/02/2020

DISTRICT HEALTH OFFICER
MBARARA DISTRICT LOCAL GOV'T

Dr. Peter Ssebutinde
DISTRICT HEALTH OFFICER

Appendix 10: Participant consent form for interviews

PARTICIPANT CONSENT SHEET

Barriers and facilitators of investigation coverage among index tuberculosis case contacts in rural Mbarara district, Uganda

1. I have been given a Participant Information Sheet which explains the nature and processes involved in this study, which is attached hereto;
2. I was given time to read it, or had it read to me, in the language I best understand;
3. I was given time to ask any questions I wanted to and found any answers given to me to be reasonable and satisfactory;
4. I believe I fully understand why the study is being conducted and what the intended outcomes will be;
5. I understand that there will be no immediate benefit to me, should I agree to participate, nor will I receive any payment; conversely, participation will not cost me anything but my time;
6. I understand that, even if I initially consent to take part in the study, I may subsequently withdraw at any time and would not be required to give any reasons; if that happened, any data collected about me for the study would immediately be destroyed, unless I give consent for it to be retained
7. I have been given a range of contact details listed below. If I require further information or become concerned about any aspect of this study, I am free to speak to any of these contacts.

Contact details:

Paddy Mutungi Tukamuhebwa (Principal Investigator)
Tel: +256774465686
Email: paddytmjwm@gmail.com

Dr Ntombizodwa Ndlovu (Supervisor)
Senior Lecturer and MSc Research Coordinator
School of Public Health
University of the Witwatersrand
Tel: +27 (0) 11 717 2311
Email: zodwa.ndlovu@wits.ac.za

Dr Pascalia Munyewende (Supervisor)
Programme Manager
Sub-Saharan African Consortium for Advanced Biostatistics training
Tel: +27 (0) 117172492
Email: pascalia.munyewende@wits.ac.za

Professor CB Penny, Chairperson of the Human Research Ethics Committee (Medical) at the University of Witwatersrand, on telephone no. 011 717 2301, or by e-mail at Clement.Penny@wits.ac.za.
Ms Z Ndlovu or Mr Rhulani Mkansi, Committee Secretariat, telephone nos.: 011 717 2700 or 1234, or by e-mail at Zanele.Ndlovu@wits.ac.za or Rhulani.Mkansi@wits.ac.za

Name of Participant: _____

Date: _____

Place: _____

Signature or mark _____

Witnessed by:

Name of Witness: _____

Signature: _____

Date: _____